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CANCER OF THE MOUTH AND TONGUE.*

BY J. COLLINS WARREN, M.D.,

OF BOSTON, MASS.

THE anatomical and physiological conditions which are to be reckoned with in operations upon the mouth and tongue combine to make the problem of surgical interference in this region more complicated than in almost any other portion of the body. This becomes evident at once when we review the great variety of operations which have been developed for the radical cure of cancer. It has been the aim of the reporter to refer briefly to the modern methods adopted with this end in view, and to present such data as are suggestive of the lines along which the operation of the future is to be worked out, and the operative surgery for cancer in this region placed upon an equality with that designed for the treatment of cancer in other regions of the body. A brief statement is, therefore, presented of the recent studies of the lymphatic system of the tongue and mouth as viewed from a surgical standpoint; also a consideration of the conditions which have been thought to predispose to cancer, the evolution of the operative treatment, and, finally, the results obtained by operation in the service of a general hospital.

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The statistical data on which this paper is based are derived from the study of 172 consecutive cases of cancer of the tongue and mouth which appear in the records of the Massachusetts General Hospital during the 15 years from 1890 to 1904, inclusive.[1] Only cancers of the tongue and mucous surfaces of the mouth have been considered. Sarcoma, cancer of the upper jaw arising in the antrum, adamantine epitheliomata, and other tumors originating in the dental membranes have been excluded, together with all cases in which pathological examination did not confirm the diagnosis, or recurrence and metastasis did not prove the diagnosis to be correct.

ANATOMY.

There have been no notable contributions to the existing knowledge of the gross anatomy of the muscles, blood-vessels, nerves and mucous membranes of the tongue and floor of the mouth, in recent years, but the lymphatic vessels and lymph-nodes of this region have been made the subject of special study by Poirier, Kuttner, Crile and others, particularly with a view to the relation between these structures and the operative surgery of cancer of this portion of the body. A brief summary of the existing knowledge of these lymphatics may be made as follows:

The lymphatic capillaries on the dorsum of the tongue form a delicate network in the anterior part of that organ, which becomes coarser toward the base, and surrounds the papillæ circumvallatæ at their posterior margin. Along the borders of the tongue, this network gives off tree-like branches which constitute the origin of a series of lymph-trunks running to different groups of lymphatic glands. There is a sharp line of separation between this system and that which drains

[1] These cases have been collected and analyzed by Drs. R. B. Greenough, C. C. Simmons and R. M. Green, by the consent of the Visiting Surgeons and with the assistance of the Administrative Department of the hospital, and the statistics will be published later in more detail. No cases operated upon since 1904 have been included, in order that at least three years' time may have elapsed after every operation.

the base of the tongue, and the space between it and the epiglottis, bounded laterally by the tonsils. The capillary lymphatics of this latter region have an entirely distinct point of fetal origin; the lymph from this region is collected into two large vessels on either side behind the tonsils, which pass through the muscles of the pharynx and empty into the superior deep cervical glands.

The lymphatic vessels given off from the border and under surfaces of the tongue are more numerous in front. One vessel is deserving of special notice, for it runs from the neighborhood of the frenum, forming a long loop along the outer border of the omohyoid muscle, and reaches the deep cervical glands low down in the neck, thus forming an almost direct route from the chin to the clavicle. The remainder of the lymphatic vessels from the border of the tongue pass through the submaxillary group of lymphatic glands, and empty into the largest of the superior deep cervical glands lying near the bifurcation of the common carotid. The lymph-trunks from the dorsum of the tongue follow in a general way the course of the lingual artery, but in the middle line some vessels run through one or two small glands between the geniohyoglossus muscles, and communicate, some with the superior and some with the inferior group of deep cervical glands.

The superficial lymphatics of the tonsils and upper portion of the pharynx communicate almost directly with the deep cervical glands, while the mucous membrane covering the cheek and the alveolar process of the upper jaw is drained more directly into the submaxillary group.

There may be said to be four groups of lymphatic glands which are of special interest to us surgically in connection with cancer of this portion of the body. These may be described as (1) the lingual group; (2) the submaxillary group; (3) the superior deep cervical group; and, (4) the inferior deep cervical group.

The *lingual group* is composed of glands lying on the mylohyoid muscle and between the geniohyoglossi, and occa-

sionally near the terminal portion of the lingual artery. The glands are in close relation with the group of muscles which form the diaphragm of the mouth, and are a part of the system which drains the tip and the anterior two-thirds of the dorsum of the tongue.

The *submaxillary group* is found principally in the digastric triangle in more or less intimate relation with the submaxillary salivary gland. The glands of this group are adherent to the capsule, or lie between its folds, and lymph-tissue is even said to exist inside the capsule of the salivary gland itself. Glands continuous with these, and forming part of this group, extend as far back as the parotid. The submaxillary group receives afferent vessels from the border of the tongue as far back as the fauces, from the middle section of the anterior half of the tongue, the under surface of the tip of the tongue and the floor of the mouth. Associated with this group is a small chain of glands in the neighborhood of the hyoid bone.

The *superior deep cervical group* is composed of glands lying on the sheath of the internal jugular vein and on the carotid artery. The largest and most important gland lies at the point of division of the common carotid, or somewhat higher, and receives a large number of afferent vessels coming from the mouth and tongue. This group of glands extends upwards as high as the base of the skull, and drains all parts of the mouth, tongue and fauces and the upper part of the pharynx. Anastomosing with this group is a small cluster of glands beneath the lower end of the parotid salivary gland, receiving vessels from the anterior surface of the palate, which has a lymph drainage separate from that of the rest of the mouth and pharynx.

The *inferior deep cervical* or supraclavicular glands are those below the point of crossing of the omohyoid muscle and the internal jugular vein; they reach down behind the clavicle and receive some branches directly from the tongue, both from the apex and the base. The terminal branches of this chain on the left side at least, empty directly into the jugular

and subclavian veins independent of the thoracic duct. This chain also drains the floor of the mouth in its anterior part. Both of the deep cervical groups are more or less covered by the sternomastoid muscle, and are adherent to the deep layers of its sheath.

From a study of the lymphatic systems of the mouth and neck, we have brought home to us very clearly certain anatomical explanations of clinical symptoms bearing upon the problem of surgical interference. The base of the tongue is, anatomically speaking, separate from the body of that organ. The lymphatic systems of these two areas are quite distinct; thus, it is clear that in a large number of cases of cancer of the anterior portion of the tongue, the part behind the papillæ circumvallatæ can be spared. Although it is claimed that a lymphatic injection mass can be forced into both halves of the tongue from a given point, it is still obvious that the communication is not a direct one. It is probable that the lymphatic anastomosis between the right and left halves of the tongue is not a free one, and although the stream, as in other forms of cancer, may readily be diverted from its direct course by inflammatory or cancerous blocking of the lymphatic trunks, yet in early cases we may well expect that cancer should be limited to one side of the median raphé. If this were not the case it would be difficult, indeed, to explain in so many cases the radical cure of early cancer of the tongue by removal of that half of the tongue containing the disease.

The lymphatic drainage of the floor of the mouth involves even wider areas than that of the tongue itself. All of the muscles in this region are studded with lymph-glands, and the salivary glands from the sublingual in front to the parotid behind, have lymphatic glands in intimate relation with them, if not actually included within their capsules. All of these lymphatics may be regarded as way-stations on the main line leading to the deep cervical glands of the superior or inferior group. The direct lymphatic communication between the anterior portion of the floor of the mouth and the deep cervical

glands of the inferior group, must always be borne in mind.[2] Cancer of the tongue appears to involve the upper deep cervical glands primarily, whereas cancer of the floor of the mouth first attacks the submaxillary group (Wölfler). Cancer at the tip of the tongue, or of the floor of the mouth, near the frenum, passes first to the submental and sublingual group. According to Butlin, the lymphatic glands may be involved within a few weeks of the origin of the primary disease, but, on the other hand, several months may elapse before glandular involvement occurs.[3]

ETIOLOGY.

When all is said, little is known with regard to the etiology of cancer of the tongue and mucous membranes of the mouth. In this region more than most others, chronic irritation appears to be a contributing if not an exciting cause, and a number of different inflammatory conditions have been cited by different authorities as predisposing, or precancerous, conditions. Leucoplakia, or leucoma, is a chronic disease which may remain for years unchanged. In many cases, however, a tendency develops to induration, and even ulceration. There is first an hypertrophy, and then an ingrowth into the parts below.[4] Chronic ulcers, cracks and fissures, with or without hypertrophy of the mucous membrane, the direct result of the mechanical irritation of the teeth (dental ulcer), undoubtedly

[2] The reporter recalls in this connection a case of cancer of the lip with involvement of the submental glands, which was followed shortly by involvement of the supraclavicular glands without intervening disease. Among the hospital cases, also, there was one of carcinoma of the upper jaw, inoperable, in which a cancerous gland was removed from the axilla.

[3] There were 7 cases of cure of cancer of the tongue in the Massachusetts General Hospital series, in which no neck dissection whatever was done. The duration of the tumor in these cases was from 2 to 24 months.

[4] In 159 cases of cancer of the tongue quoted by Von Bergmann, leucoplakia was seen in 34.6 per cent. But, according to Butlin, in the greater number of cases, leucoplakia is not followed by cancerous degeneration.

favor malignant growth. Inflammation of the gum due to chronic pyorrhœa, with constant discharge of pus from around dead roots and carious teeth, may give rise to thickening and breaking down of the epithelium, and the development of cancer of the mucous membrane of the alveolar process. Epithelioma may also arise from the periodontal membrane. Persistent glossitis may give rise to more or less permanent structural changes in the tongue and long-continued ulceration, which must always be regarded with suspicion.

The opinion is wide-spread that both syphilis and smoking are important etiological factors in cancer of the mouth. Thus, Poirier would call cancer of the tongue, "cancer des fumeurs syphilitiques," and cites in corroboration of this opinion 32 cases of cancer of the tongue, all of which were smokers, and 27 of which had syphilis. Fournier also attributes to syphilis an important rôle in the etiology of cancer of the tongue and mouth. In 100 cases of syphilis, he describes 14 cases of leucoplakia, and in 184 cases of buccal cancer, 155 had syphilis. On the other hand, Whitehead's figures do not seem to point in this direction, for of 104 cases cited by him a definite history of syphilis was obtained in only 7; 62 of these cases, however, were smokers, and in the majority of cases the cancer was on the side of the tongue which came in contact with the pipe. In our own series of cases, and in those of Meller, tobacco and syphilis appear to be of slight importance. Most of us will probably agree with Butlin that syphilis is an indirect rather than a direct cause, as tending to produce those conditions of the tongue which predispose to cancer.

Owing to its appalling danger, there are few diseases in which an early diagnosis is more essential than in cancer of the mouth. There is no question but that the public should be better instructed in the hygiene of the mouth and teeth, and taught the importance of seeking medical advice for any chronic lesion of this portion of the body. "The practitioner of dentistry cannot be too conscious of the power he possesses of preventing death from cancer, and of the awful responsibility he incurs for overlooking precancerous conditions, or

early malignant disease of the mouth (Roughton)." Butlin calls attention to the fatal tendency of the physician to treat early cancer as syphilis, or as some other less serious affection of the mouth: "To give the patient 'a chance' is, under such circumstances, to give the carcinoma a chance to form an irresistible hold, and to take away all hope of complete recovery from the patient."

PATHOLOGY.

From the point of view of origin, there are two types of carcinoma of the mucous membranes of the mouth. The first arises from the epidermic layer of the mucous membrane, and the second from the epithelial glands immediately beneath its surface. Squamous-cell carcinoma, or epithelioma of the mucous membrane itself, is the prevailing type. In 80 cases of cancer of the tongue at the Middlesex Hospital, 76 were of this variety. It does not appear that cancer in other regions of the mouth differs materially from that seen in the tongue. A case of so-called "Paget's disease" of the jaw has been reported by Smith, which doubtless represents an early stage of epithelioma. Of squamous-cell carcinoma, two varieties are recognized,—basocellular and planocellular (spirocellular), or, as the French term them, "épithéliome tubulé" and "épithéliome lobulé," the former containing cells resembling those of the rete mucosum, and the latter containing the coarser type of squamous cells, with cell nests. Poirier in 20 cases found 9 épithéliomes lobulés, 2 épithéliomes tubulés, and 9 cases of the two varieties combined.

The situation and relative frequency of cancer in the different portions of the buccal mucous membrane may be appreciated by a consideration of the statistics of the Massachusetts General Hospital; 172 cases of cancer of the mouth showed the following distribution: There were 98 cases of cancer of the tongue and floor of the mouth; 40 of cancer of the mucous membrane involving the lower jaw, 14 of the mucous membrane involving the upper jaw, 11 of the tonsil and soft palate, and 9 cases of the mucous membrane of the

cheek. This relative frequency of cancer in these regions conforms closely to that of the 207 cases reported by Meller, and those of Boyd and Unwin, Morestin, Gurlt, and other writers.

It is a well-established fact that malignant disease of the mouth spreads both by direct contiguity, and by extension to lymphatic glands. In no other region of the body does growth by contiguity assume a greater importance, and in the majority of cases recurrence appears to be due to the failure of the surgeon to leave a sufficient margin of healthy tissue in the removal of the primary disease. It has been stated that many of the glands removed at operation though palpably enlarged, did not show cancerous involvement on microscopic examination (Jacobson, 15 per cent.). It would be rash, however, to act on the assumption that they were not involved to a certain extent, and that the microscopic examination had not failed to detect a few of the implanted cancer-cells.

There has been much discussion as to whether the lymphatic vessels leading from the primary growth to the nearest lymphatic glands were not possible sources of recurrence in cases in which the two-stage operation is performed. It has been held by some that epithelioma of the tongue, unlike cancer of other organs,—such as the breast,—extends not by continuous growth in the lymphatics (Handley), but by lymphatic emboli, and some of the advocates of the two-stage operation support this view. The success of the two-stage operation in many cases would appear to justify this belief, but it cannot be said to have obtained general credence. Boyd and Unwin are emphatic in stating that recurrence may occur from the failure to remove cancerous lymphatic vessels, and the advocates of the Kocher, Langenbeck, Crile, and other more radical operations, base their plan of operative treatment upon the belief that the whole lymph-bearing tissue,—vessels as well as glands,—should be removed in cancer of this region just as in any other portion of the body.

Internal, or remote, metastases are apparently most unusual. In 147 autopsies performed at the Middlesex Hospital

on cases of cancer of the tongue, the occurrence of internal metastasis was as follows: liver, 8; lungs, 7; pleura, 4; suprarenal, 3; heart, 2; and other regions, 1. Crile found in a study of 4500 cases of cancer of the head and neck that internal metastasis occurred in less than 1 per cent. We may safely conclude, therefore, that it is the local disease and the regional lymphatic metastasis which is the serious consideration of a surgical attack upon cancer of the mouth and tongue.

DIAGNOSIS.

Enough has been said about the so-called precancerous conditions of the tongue and buccal mucous membranes to indicate the importance of early diagnosis. The symptoms actually pathognomonic of cancer develop only at a stage of the disease when operative interference can promise little, if any, hope of radical cure. A large indurated ulcer extending from the side of the tongue across the floor of the mouth to the alveolar process and accompanied by enlarged lymph-glands of the submaxillary or deep cervical group permits of little doubt as to diagnosis, and still less as to the ultimate result. It is the early and doubtful cases that require especially the surgeon's consideration.

The indiscriminate use of specific treatment as a means of diagnosis should be thoroughly discouraged. The therapeutic test is often fallacious, according to Hutchinson. Iodide of potassium often improves an epithelioma and relieves pain, and hygiene of the mouth, with careful feeding, often helps to improve local conditions. Antisyphilitic treatment should certainly not be continued for a sufficient length of time to allow any perceptible increase of the growth.

In the very early and doubtful cases, an exploratory operation is the safest and most scientific solution of the problem of diagnosis. This should not be attempted, however, until all the preparations have been made for performing the complete operation if it prove to be required. For such an exploratory operation, if possible, the whole of the primary growth should be excised, in preference to the removal of a small

portion. This tissue can be submitted to a pathologist, who should always be present at an operation of this character. A "frozen section" can then be made and a positive diagnosis returned immediately. The more material given the pathologist, the more accurate his diagnosis, and the less likelihood of spreading the disease by setting free living cancer-cells in the depths of the wound. Removal of the surface of the growth by curetting can hardly be considered a sufficiently exact method for general use, and the results of punching out specimens for examination may lead to cancer extending along the exploratory tract, as was shown by Richardson in a case of cancer of the breast. The disturbance of a primary lesion any considerable length of time before an operation is to be avoided if possible, and it is for this reason better to defer the exploration until the patient has been anæsthetized and prepared to undergo the radical operation, if it should be required.

OPERATIVE TREATMENT.

Operations for the radical cure of cancer of the tongue and mucous membranes of the mouth have been developed by different surgeons along several different lines. We readily distinguish three main classes of operations for the removal of the primary tumor: (1) the intrabuccal operation, (2) the approach beneath the jaw, and (3) operations involving the division or resection of the lower jaw. For the removal of the lymphatic glands beneath the jaw and in the neck, a variety of operations are described, differing chiefly in the extent of the operative attack, and in the thoroughness with which the lymph-glands are removed. Surgeons differ also with regard to the preliminary treatment of their patients and the technical details of the conduct of the operation.

Preliminary Treatment.—The reporter has long believed that a proper cleansing of the mouth by a dentist, with the removal or treatment of carious teeth, should precede any operation in the mouth. It is not to be expected that the buccal cavity can be made an aseptic field of operation, but the number and variety of pathogenic bacteria which normally inhabit it,

can surely be diminished. The hypodermic injection of atropine, $^1/_{100}$ grain, one-half to one hour before operation, is of decided benefit in reducing the flow of mucus and promoting a quiet anæsthesia. The hypodermic injection of morphia, ¼ to $^1/_6$ grain, before operation, is also practised by many surgeons with the same purpose in view.

Anæsthesia.—Ether is the anæsthetic most commonly employed for operations upon the tongue and mouth, although chloroform is used by a number of surgeons (Morestin, Eisendrath, Küster). In the Massachusetts General Hospital cases, ether has been used exclusively.

The position of the patient is influenced somewhat by the anæsthetic employed, and by the different methods of preventing the access of blood to the respiratory tract. The upright position in an operating chair, as used by some surgeons at the Massachusetts General Hospital, or in a rocking-chair, as advocated by Whitehead, offers certain advantages. In this position, the blood escapes freely from the mouth, but anæsthesia cannot be carried to its full extent, and coughing, and even vomiting, sometimes hamper the surgeon and perhaps may infect the wound. The lateral position, as recommended by Butlin, allows the blood to escape from the mouth freely, but does not offer the surgeon an unrestricted operating field. It is doubtful whether this position could be used except with the preliminary laryngotomy employed by Butlin. Poirier and other surgeons advise Rose's position for the intrabuccal operation, while Crile and a number of American surgeons have employed the semi-upright position, combined with bandaging of the extremities and intubation of the pharynx.

Some surgeons insist strongly upon the importance of ligature in the neck, by a preliminary incision, of the lingual or external carotid arteries in order to diminish hemorrhage, while others (Whitehead) consider this detail unnecessary. Crile advocates the use of temporary clamps upon the common or external carotids, on one or on both sides, and claims to obtain a practically bloodless field by this manœuvre. He states that he has clamped the carotid in 61 cases, without

either immediate or remote complications. His method of diminishing venous hemorrhage is by the partially upright position.

There has been much discussion upon the propriety of performing the intrabuccal and the neck operations in two stages. The mortality of the combined operation as stated by Butlin in 13 cases, was 23 per cent. as opposed to a 7 per cent. mortality when the operation was done in two stages. Associated with this question is the discussion of whether the lymphatic vessels are the site of continuous cancer growth, as held by some, or whether embolic infection of the lymph-glands occurs without intervening disease of the lymphatics. Butlin, Crile, Whitehead and Jacobson advocate especially the two-stage operation, while Kocher, Von Bergmann, Poirier, Kuttner and Eisendrath perform the local operation and the neck dissection at one sitting. The two-stage operation is designed to diminish shock and sepsis, and to lower the rate of mortality. It entails, however, an added nervous strain, and is an ordeal many patients might be unwilling to undergo. Its weakest point, however, is that it fails to remove the zone of lymph-bearing tissue behind the jaw. It may be that the two-stage operation represents only a stage in the development of the operative surgery of cancer of the tongue, and that with greater resources and improved technic the mortality of the operation may be in time reduced, so that the whole radical operation can be safely performed at one sitting, and the disadvantages and dangers of delay avoided.

The protection of the air-passages in operations about the mouth presents many difficulties. The upright position of the patient may give sufficient protection without other aid, but that this is not invariable is shown by the other expedients which have been devised. Butlin performs a preliminary laryngotomy and lays stress upon its advantage in favor of the prognosis of the operation. The tube is withdrawn as soon as the operation is complete, the wound heals promptly, and leaves an almost imperceptible scar. Jacobson also recommends laryngotomy, while the continental surgeons more commonly

employ tracheotomy. Both of these procedures are supplemented by packing the pharynx with gauze above the tube to prevent leakage into the air-passages from above. Crile has devised a method of intubation of the pharynx which appears to be satisfactory in the majority of cases, and has been widely adopted in America. Two rubber tubes as large as can be drawn through the nares, are pushed down to the epiglottis, the tongue is drawn well forward, and gauze packing is introduced about the tubes into the pharynx, which should be previously cocainized. These tubes are connected by a Y tube with a glass funnel, and ether is administered by the drop method on a piece of gauze placed over the top of the funnel.

To summarize these details of operative technic, it may be said that the upright or semi-upright position with intubation of the pharynx or tracheotomy are the methods most commonly employed for either intrabuccal or more radical operations; that the use of a clamp on the common carotid, or ligature of the external carotid is a wise precaution in undertaking the more extensive operations, and that the operation in two stages, allowing an interval of ten days to two weeks before the neck dissection, although open to certain criticisms is the most popular procedure.

VARIETIES OF OPERATION.

TONGUE AND FLOOR OF MOUTH.—The operations upon the tongue and floor of the mouth have been roughly divided into three groups: (*a*) intrabuccal operation, (*b*) removal below the jaw, and (*c*) removal by division of the jaw.

Intrabuccal Operations.—The typical intrabuccal operation is that described and practised so well by Whitehead. It was designed before the dissection of the various groups of lymphatic glands was introduced as a routine method, and is done entirely independent of the neck operation, which may or may not be performed immediately or at a subsequent period. The upright position of the patient is essential. A ligature is passed through the tip of the tongue, which is drawn forward, and upward to its fullest extent. The frenum

and the mucous membrane on one side of the tongue as far back as the anterior pillar of the fauces, are divided. When the whole tongue is to be excised, the same is done on the other side. If one-half of the tongue only is to be removed, an incision is made along the dorsum on the median line, and the tongue split back along its raphé. The surgeon now draws the diseased half upward and forward to make the geniohyoglossus muscle tense, and divides it close to its point of origin. The tongue can now be drawn out, so that the remainder of the operation is almost extra-oral. Whitehead operates upon the glands of the neck at a second operation at a later date, when he has reason to consider them to be malignant, but it is clear from the various descriptions of his operations, that there are many cases in which the intrabuccal operation is performed alone.

Butlin performs an intrabuccal operation which does not differ essentially from that of Whitehead, although he places his patient in the lateral position and performs a preliminary laryngotomy. Butlin, however, lays great stress upon the dissection of the neck, which he performs as a secondary operation. He aims to remove all of the lymphatic glands and the lymph-bearing tissue of the inferior and superior deep cervical, the submaxillary and the sublingual groups. The muscles and the great vessels are cleaned of fascia and fat, the submaxillary salivary glands are removed entire, and the submental region thoroughly dissected. Where the disease is near the median line, both sides of the neck are dissected.

Poirier performs an operation similar to that of Butlin, although the intrabuccal operation and the neck dissection are done at one sitting; the two wounds, however, do not communicate.

Crile's "block dissection" of the neck deserves special mention, as having been worked out on a physiological and pathological basis. Crile has proved that the structures of the neck can be safely sacrificed in the extirpation of cancer to an extent that has not been before believed. The removal of the sternomastoid muscle causes little inconvenience; the omo-

hyoid, the digastric, the sternothyroid and sternohyoid and the platysma are of minor importance. Unilateral excision of the vagus is attended by hoarseness of the voice, but this is of very little consequence. Unilateral excision of the phrenic is followed by less than half paralysis of the diaphragm. Unilateral excision of the hypoglossal nerve affects the tongue somewhat in speech, but a fair degree of compensation is acquired. Bilateral excision is usually fatal from pneumonia. Removal of one or even both internal jugulars is of little consequence, but a compensating route for collateral circulation must be assured before the second jugular is tied. Thus, all of the structures of one side of the neck, with the exception of the common carotid artery, may be sacrificed if necessary. Crile has elaborated the technic of this operation to permit the removal of these tissues in a block dissection. With the semi-upright position, safeguarded by the pneumatic suit, intubation of the pharynx and temporary closure of the common carotid, this extensive dissection can safely be performed. In cases of cancer of the tongue and floor of the mouth, Crile performs an intrabuccal excision similar to Whitehead, and follows this, after a period of about two weeks, with a block dissection of the neck, going up to, but not into the buccal wound. He lays stress also upon the reduction in the number and intensity of surgical contacts, such as forcible retraction, vigorous and repeated sponging, and blunt dissection. Hemorrhage, mismanaged anæsthesia and duration of operation are also important factors in the production of shock. Crile also follows up his operation upon the neck by X-ray exposure of the open wound during the period of convalescence.

Among the 62 cases of cancer of the tongue and the floor of the mouth which were operated upon at the Massachusetts General Hospital, 20 intrabuccal excisions of the tongue were performed, and the end results are known in 19 of these cases. In 7 cases, the neck dissection was performed, while in 13 no operation upon the neck was done. Of all the 20 cases 8 are now alive and well, or have died without recurrence over

3 years from the time of operation, giving 40 per cent. of cures, a much higher ratio of successful cases than has been obtained by other methods of more radical operation; 7 of the 8 cures resulted from intrabuccal excision of the growth without the dissection of the neck. The operative mortality of the 20 intrabuccal operations was 1 case, 5 per cent., death in this instance being due to general sepsis. To compare with these figures, we have the report by Whitehead of 139 operations for cancer of the tongue, 101 of which were for cancer restricted to the tongue itself, with a mortality of only 3 per cent. So far as the Massachusetts General Hospital cases are concerned, it would appear that the early and more favorable cases were the ones chosen for the intrabuccal operation. All of these successful cases are substantiated by microscopic examination of the specimens, and it is hard to believe that cures would have resulted had the excision not been performed before the glands of the neck had become involved.

Operations Below the Jaw.—Although many modifications of this operation have been devised by different surgeons, the fundamental principles may be attributed to the early description of this operation by Kocher. An angular incision is carried from the chin to the ear, reaching downward as far as the hyoid bone. The submaxillary group of glands are dissected free, and the mouth is entered below the jaw by division of the mylohyoid. The diseased portion of the tongue and floor of the mouth is removed below the jaw, and the dissection of the neck and removal of lymphatics and other cancerous tissues is carried to such an extent as may seem to be required. This is the operation which commonly goes by Kocher's name, although he later adopted a division of the lower jaw after the method of Syme.

Regnoli's operation, one of the oldest from an historical point of view, makes use of the same principles as Kocher's, and removes the tongue through the middle of the floor of the mouth beneath the chin. It can be applied to cases of cancer near the tip of the tongue, and at the frenum, but should be supplemented according to modern views, by dissection of the

neck. In cancer of the floor of the mouth, on one side only, in this region, the submental incision may be limited to one side and the operation made partly buccal and partly cervical, as the reporter has done with success on several occasions. Küttner performs the Kocher operation, and recommends a "luxurious" extirpation of the primary growth. Eisendrath performs a similar operation, as do Kammerer and Willy Meyer. Boyd and Unwin consider that removal of the tongue beneath the jaw invites cancerous infection of the neck, and increases the danger of recurrence. The two-stage operation cannot well be performed by this method, and for that reason alone the operative mortality must probably be higher than with intrabuccal operations. In the Massachusetts General Hospital series, Kocher's excision below the jaw was performed in 29 cases, with an operative mortality of 3, or 10.3 per cent., death being due in each case to sepsis and bronchopneumonia. There were 2 cures among the 29 cases, or 6.9 per cent. To contrast with these figures, we have Kocher's own cases as reported by Sachs; 58 operations, 12 of which were by excision beneath the jaw, with an operative mortality of 8.3 per cent. Meller reports 2 cases only by this method of operation, both of which survived. Butlin estimates the mortality of this operation in 62 collected cases as 20 per cent. There can be little question that the operative risk is much increased over that of the intrabuccal operation; as far as cure is concerned, the cases submitted to this operation at the Massachusetts General Hospital cannot fairly be compared with the earlier and more favorable cases in which the intrabuccal operation was performed.

Excision by Division or Resection of the Jaw.—Langenbeck's method, as modified by Von Bergmann, is the one generally referred to in literature when it is intended to reach the disease through the lower jaw by dividing the bone. An incision is made from the angle of the mouth through the cheek to the masseter muscle, and continued downward through the submaxillary and hyoid regions. The lingual artery is tied and the lymphatic and salivary glands are dissected and

left hanging to the floor of the mouth. The lower jaw is then divided obliquely with a Gigli saw, the fragments are separated and the disease removed as on the surface of the body. Von Bergmann sutures the remaining mucous membrane in such a way as to establish a fistula to drain the region of the epiglottis and base of tongue. The bone is wired. This operation is one adapted as well to the removal of malignant disease of the floor of the mouth, tonsil, soft palate or pharynx, as of the tongue. It is necessarily employed in connection with excision of a portion of the jaw, when the jaw itself is involved in the disease.

The operations of Sedillot or Syme, which aim to expose disease of the tongue and floor of the mouth by a median incision, and division of the jaw at the symphysis, belong in the same class. Operations of this character are designed especially for advanced cases of carcinoma, and give a high mortality. In the Massachusetts General Hospital series there were 13 operations for cancer of the tongue and floor, in which the jaw was divided or excised, and 4 of these cases died soon after operation, a mortality of 30.7 per cent., which may well be contrasted with the 10 per cent. mortality of the Kocher operation, or the 5 per cent. of the operations of the Whitehead type. In the Massachusetts General Hospital series also, there were no cures in any of these 13 cases, although in 2 of the number a final report could not be obtained. The causes of death were: sepsis in 1 case, and pneumonia with or without sepsis in 3. Sachs gives the operative mortality of jaw resections as 19 per cent. Butlin gives the mortality for 47 operations as 25 per cent. Meller reports 7 cases of cancer of the tongue in which jaw section, or resection was done, and of these 3 died soon after operation, or 42.8 per cent. It would be futile to deny that section or resection of the jaw adds enormously to the gravity of the operation, and it is only to be regretted that many patients present themselves with their disease so far advanced that one of these grave operations must be performed, if anything at all is to be done to ward off the otherwise inevitable death. It is true that in none of the

Massachusetts General Hospital cases was this desired result obtained, but the attempt at least was made, and in the long run life was prolonged. When we realize the immense advantages of the free approach to the disease which is given by division of the jaw, it becomes a question whether, with a proper technic, this should not be adopted more frequently (and in early cases) instead of being placed among the discarded features of the operation.

A good deal is said about anatomical relations, in connection with these operations, but it must not be forgotten that in the words of a distinguished surgical teacher: "Anatomical considerations must be made subservient to the one grand purpose of the operation,—eradication of the disease."

Operations for the cure of cancer in this region are distinctly less far advanced than those for cancer of other portions of the body. The mechanical difficulties to be overcome are greater; the lower jaw offers a barrier to the free sweep of the knife. The presence of important nerves and vessels in the neighborhood, and the severity of the operative attack, add greatly to the dangers of the operation itself, while the close relations of the air-passages and of the buccal tract make the problem of a safe and speedy convalescence much more difficult. It is not to be wondered at that a large number of cases have hitherto been regarded as bad surgical risks, and that many are turned away as inoperable cases when they first present themselves at the clinic. Of 172 cases of cancer of the tongue and mouth at the Massachusetts General Hospital, 50, or 29 per cent., were already inoperable, and 10 others refused any operation.

Modern research has given a distinct impulse to surgery of the mouth. Discussion turns no longer on primary ligature of the lingual artery, but upon the distribution of the cervical lymphatic glands. All writers dwell upon the danger of handling the diseased tissue, and of bringing softened gland-substance or the secretion of ulcerated surfaces in contact with the wound, and some go so far as to irrigate the open

wound with antiseptics to prevent the artificial propagation of the disease.

The extent of operation upon the tongue itself is a question upon which authorities do not agree. In cancer of the breast, or of the uterus, there is of course no question but that the whole of the organ is to be removed. The conditions in the tongue, however, are peculiar. Almost completely separated into two symmetrical parts by the median raphé, it has many of the characteristics of a double organ. There are two sets of blood-vessels, two sets of nerves, and a double set of lymphatics. Each of these systems, though anastomosing across the middle line, is anatomically distinct. To this is added the clinical experience so often noted,—that cancer remains restricted to one side, and does not readily cross the raphé. This barrier, however, is an imperfect one, and in advanced disease reliance cannot be placed upon it. In early cases, however, the healthy half of the tongue can frequently be saved. It is also worthy of note that cancer does not spread toward the tip of the tongue, but rather toward the base. For this reason, the tip can often be saved and the edges stitched together, or folded on itself to form the so-called "parrot-tongue"; a measure which aids in closing the wound and helps to improve the speech. Especially is it to be remembered that the capillary lymphatics of the base, and those of the body of the tongue, are developmentally and anatomically quite distinct, for in the majority of cases this gives the surgeon the opportunity to leave enough of the base of the tongue to form a serviceable stump.

Of 98 cases of cancer of the tongue and floor of the mouth at the Massachusetts General Hospital, 62 were operated upon, but in 5 cases the end result could not be determined. From the remaining 57 operations, 10 cures resulted; 9 of these cases were alive and well at the following periods after operation: $3^{1}/_{3}$, $3^{7}/_{12}$, $4^{1}/_{6}$, $6^{8}/_{12}$, $7^{6}/_{12}$, $11^{8}/_{12}$, $12^{4}/_{12}$ and 13 years, and 1 died of heart disease 6 years after without recurrence. One of the 10 had a local recurrence (or a new attack of the disease) 8 years after the first operation, but this was removed

and the patient has now been well for 5 years. The percentage of cures in these cases is thus 17.5 per cent., or if (following the example of Meller) only the total of operated cases is considered, 10 in 62, or 16 per cent. Carrying the time limit on to 5 years after operation, all of the cases operated upon in 1902 and 1903 are thrown out, leaving 45 cases with 7 cures, or 15.5 per cent. Comparison with other statistics is difficult, because of the varying requirements established by different writers. The Massachusetts General Hospital cases are taken consecutively from the record books. All of the cured cases are supported by microscopic examination of the specimens, and no case is included which has not survived a period of at least 3 years since operation. The best results claimed by any surgeon are those of Riedel (of Jena),—24 operations with 8 cures, or $33^1/_3$ per cent. (Jahr). Butlin gives 24.7 per cent. as his latest percentage of cures. From these figures the percentages run down, depending largely upon the rigidity with which the statistics are scrutinized, to much smaller figures. It is probable that 17 per cent. comes close to the average expectation of cure in any of our general hospitals.

The operative mortality of operations for cancer of the tongue and mouth depends largely upon the nature of the operation performed, and has been already discussed. Of the whole number of 62 operations, 8, or 12.9 per cent., resulted fatally.

When the disease was confined to the tongue or floor of the mouth, at its point of origin, as in 29 cases, cure was obtained in 31 per cent. When other structures were involved, the percentage of cures was only 3.4 per cent.

Recurrence of the disease took place in 40 of the 57 patients operated on, in whom the result is known. In only 2 cases did a patient with recurrence live over 3 years after operation.

In 13 local recurrence alone occurred. In 14 both local and glandular return of the disease, and in 8 the recurrence was in the lymphatic glands alone. Even in cases of recurrence life was prolonged by operation.

LOWER JAW.

Operations for cancer of the mucous membranes of the alveolar process of the lower jaw, and involving the bone, permit of little difference in extent, although the technical details of preparation, position of patient, anæsthesia, the use of clamps, and the protection of the air-passages, may be varied as in the case of operations upon the tongue. Any radical operation involves the excision of a part, or the resection of the whole of one or both halves of the inferior maxilla. There were 40 cases of cancer of the mouth involving the lower jaw in the Massachusetts General Hospital series, 28 of which were submitted to operation; 10 patients died as a result of the operation (35.7 per cent.),—a large mortality,—and there were 5 cures (17.7 per cent.), or, of the traced cases, 19.2 per cent. Taking 5 years as the limit for a cure, 22 cases are available with 3 cures, or 13.6 per cent. There were no cases of recurrence over 3 years after the operation.

The operations performed upon these 40 cases were as follows:

Resection alone, 12	1	cure,	5	operative deaths.
Resection + neck dissection, 4	1	"	2	"
Resection + neck + other parts, 3	1	"	1	"
Minor operations, 7	2	"	2	"

It is thus apparent that any operation upon the lower jaw for cancer is attended by considerable risk. The causes of the 10 operative deaths were:

Shock and hemorrhage	3
Sepsis	1
Sepsis and pneumonia	2
Secondary hemorrhage	1
Debility, heart lesions, etc.	3

Bryant gives the mortality for resections of the lower jaw as 20 per cent., and from Meller's case-reports, 36 cases of cancer involving the lower jaw and requiring resection or excision, have been tabulated with results as follows: 36 cases,—7 cures (19.4 per cent.) and 6 operative deaths (16.6

per cent.). These are the only figures available for direct comparison, but they show a notably lower operative mortality, although the cures are practically the same. Because of the high mortality, the neck dissection might perhaps better be postponed for a later operation.

UPPER JAW.

Operations for cancer of the mucous membranes covering the alveolar process of the upper jaw and the hard palate, like those involving the lower jaw, admit of little variety except in the extent of the operative attack. There were 14 such cases in the Massachusetts General Hospital series, with 10 operations and no cures. Meller gives the histories of 12 such cases with 1 cure, and Boyd and Unwin 1 case, with recurrence. There were no operative deaths in the Massachusetts General Hospital series, confirming the general belief that operative attack upon the upper jaw is less dangerous than that upon the lower jaw. There were 5 total resections, 1 partial excision, and 4 minor operations, but in no case was the dissection of the neck attempted. This, however, was not the only reason for the lack of success, for 8 of the 10 cases at least showed local recurrence, and it is evident that the primary tumor was not completely extirpated. It is interesting to note that in one of the inoperable cases of this character enlarged axillary glands were removed and found to be involved with epithelioma.

TONSIL AND PALATE.

The region of the tonsil and pharynx may be approached by several different routes for the extirpation of malignant disease. "Trans-hyoid pharyngotomy," as performed by Carless, gives access especially to the base of the tongue and epiglottis. For this purpose a median incision is made from the chin to the thyroid cartilage, bisecting the hyoid bone. The edges of this wound are retracted, and the pharynx entered between the top of the epiglottis and the false cords. Tracheotomy is a necessary adjunct. Cheever enters the

pharynx through a cervical incision following the line of the angle of the lower jaw, dividing the stylohyoid and styloglossus muscles, and separating the fibres of the superior constrictor.

Mikulicz's operation involves a division of the angle of the lower jaw, and dislocation and resection of the ascending ramus. It is comparable to the operation upon the tongue of Langenbeck, and to the resections of the lower jaw, and should give a similar high mortality. Boyd and Unwin report 4 cases of cancer of the fauces, on which they performed an operation of a similar nature to Mikulicz's, with the addition of the neck dissection. There were no operative deaths, but there were no cures.

The reporter finds a modification of Langenbeck's operation combined with a block dissection, the most effective method of reaching the region of the tonsil, palate and base of the tongue. The incision runs from the angle of the mouth vertically downwards to the lower edge of the jaw and along the lower border of the jaw as far as the lobe of the ear. The cheek is separated from the bone, and thrown back. The superficial fascia of the neck which is attached firmly to the lower edge of the horizontal portion of the jaw should be divided as far back as the angle of the jaw, the facial artery being clamped, cut and tied. A blunt dissector slipped into the incision liberates the floor of the mouth on that side from the inner aspect of the bone by a few brisk to and fro sweeps of the instrument. The soft parts drop towards the median line and the approach to the tongue and the mouth is greatly facilitated. The jaw is now divided in front of the masseter and the ramus thrown backward with the skin flap. An extension of the incision downward along the anterior border of the sternomastoid muscle uncovers the infected gland area. This operation exposes the mouth and pharynx so that any disease, however extensive, becomes easily accessible, and the surgeon is, as it were, operating on the surface of the body. The primary and secondary lesions can be removed "*en bloc*," and the operation completed in a comparatively short time and

without undue hemorrhage and shock. There need not be as much hemorrhage as in an operation for cancer of the breast. In less advanced cases with the same skin incision, and without dividing the bone, the neck having been dissected, the operation on the mouth becomes a simple matter, and the diseased portion of the tongue is removed together with the glands. The facial incision recommended gives far less deformity than the splitting of the cheek, and gives access to the mouth, bone and the upper part of anterior triangle.

Of 11 cases of cancer of the tonsil, fauces and soft palate in the Massachusetts General Hospital series, only 4 were considered suitable for operation. One case, an epithelioma of the soft palate, removed by excision through the mouth was cured ($7\,^{10}/_{12}$ years). Of the other cases, 1 was merely curetted, while 2 were given radical operation with dissection of the neck, and removal or division of the jaw. There were no operative deaths, but 2 of the 3 cases had a local return of the disease, and the other died of cancer, though the site of recurrence could not be determined. Of the 7 inoperable cases, all showed enlarged glands in the submaxillary region, or anterior triangle of the neck.

Meller records 16 cases of cancer of the tonsil or palate, with 1 cure (6.2 per cent.), and quotes the figures of Hensel (7 cases and no cures); Boyd and Unwin report 5 cases with no cures. It would appear that under existing conditions, only the earliest and most favorable cases can expect radical cure of the disease, and that the local excision should be more generous if cure is to be attempted for cancer in this portion of the mouth.

CHEEK.

Standard operations for cancer of the mucous surfaces of the cheek are not yet in existence. Morestin suggests the following operation. Two long incisions starting from the labial commissure, or including a portion of each lip, and, including between them the diseased area, run as far as the anterior border of the sternomastoid muscle. Exposure and

dissection of the submaxillary triangle follows, with ligature of the facial artery, separation of the floor and of the mouth from the diseased mass; and liberation of the mass *en bloc* from its surroundings by deep dissection and by division of the jaw near the median line; division of the ascending ramus and removal of the growth. The mucous membrane of the floor of the mouth is stitched to that of the upper buccal fold. The large gap left is closed at a subsequent operation. Morestin advises light chloroform narcosis, and rapidity of operation. Although the hemorrhage is severe, but 1 of the 10 cases succumbed. He mentions 3 cases well at least two years after the operation out of a collection of 25 cases, some of which were inoperable. He emphasizes the importance of removing the part of the lower jaw which is involved in the disease. In 1 of his successful cases, an operation of this type was performed in the early stages of the disease.

Boyd and Unwin report 10 cases of operation for cancer of the cheek, involving the gums back to the coronoid process and including the sulcus of the cheek. They found intrabuccal operations unsatisfactory, nor was splitting the cheek wholly satisfactory. They advise dividing the lip and chin in the median line, and turning the cheek back. A portion of the bone may be removed, if involved, in one piece with the disease. Division of the jaw should be made or the ramus removed in whole or in part if the growth requires it. When there is danger of closure of the jaws from cicatricial contraction, a wedge of bone should be removed at the time of the operation to ensure permanent mobility of the jaw.

It would appear that Morestin and Boyd and Unwin include under cancer of the cheek, cases which we have classed under the upper and lower jaw. Boyd and Unwin, however, report 4 cures in 10 cases, 40 per cent., and Meller in his report details 8 cases of cancer of the cheek, of which 2 were cured; so that the results in the Massachusetts General Hospital series of 9 cases with 8 operations and no cures, appear to be less favorable than may reasonably be expected. The operative mortality of the Massachusetts General Hospital

cases, 2 deaths in 8 operations, or 25 per cent., is also higher than seems justified. These deaths were due to shock in 1 case, and delirium tremens in another. The 8 operations were, 3 of them of a local and palliative nature, and 5 were radical excisions, involving the jaw in 2 cases, and accompanied by dissection of the neck.

Five of the 8 operations, however, were followed by local return of the disease, and in 2 of this number there was glandular recurrence also.

RÉSUMÉ OF OPERATIONS AND RESULTS.

The prospects of radical cure by operative attack upon cancer of the tongue and mucous membranes of the mouth appear to be inferior to those devised for the cure of cancer in other regions of the body. This is chiefly due to the anatomical and physiological conditions, which make extensive operations in this region extremely dangerous to life. It may truthfully be said that surgical attempts to remove cancer in this portion of the body, have too often been confined to excision of the primary growth and that in the majority of cases even this attempt has not been sufficiently radical, and a wide enough margin of sound tissue has not been removed to justify the procedure as an attempt at radical cure of the disease. Too often the lymphatic glands are entirely disregarded; of 112 operations upon cancer of the tongue and mouth in the Massachusetts General Hospital, in only 51, or 45.3 per cent., was any attempt made to dissect the cervical lymphatics. It is true that a certain number of these operations were undertaken only as palliative measures; but in 10 of the 16 cures simple excision of the primary growth was the only operation done. From this we may judge that it was only the earliest and most favorable cases in which a cure resulted, and the total of 16 cases, or 14.2 per cent., of all cases submitted to operation, is sufficient indication that more radical operation is required if greater success is to be obtained.

Local recurrence of the disease took place in 39, of the total number of 49 operation cases, of which we have accurate

record, while glandular recurrence is noted in only 20. Of the other cases specific details are lacking.

From these figures we may conclude that the local as well as the lymphatic portion of the operation was deficient in extent.

PALLIATIVE TREATMENT.

Since the radical cure of cancer of the tongue and mouth fails in a certain, and at present considerable number of, cases, palliative treatment must be considered. It has long been claimed that the duration of life was greater after operation even when recurrence ultimately took place, than in unoperated cases. This appears to be true in our statistics. Leaving out of consideration the operative deaths (20) and the cures (16) in the whole number of 112 operations of the Massachusetts General Hospital series, the duration of life was notably longer in the cases which were admitted to operation, in every class.

	Unsuccessful operation average.	Inoperable cases average.
Tongue	12–1 months.	7–0 months.
Lower jaw	10–9 "	5–4 "
Upper jaw	14–5 "	6–5 "
Tonsil	11–3 "	6–4 "
Cheek	8–6 "	7–0 "

The attempt at radical cure might thus be considered a palliative operation in the cases where radical cure is not obtained. So far as comfort is concerned, there are no statistics to support the opinion, but it is a wide-spread one, that the comfort of the patient is much enhanced by even a partial removal of the offensive ulcerating and necrotic tissue in the mouth.

Division of the lingual nerve to relieve pain is not performed as frequently as in former days. When done, a portion of the nerve should be excised. The Middlesex Hospital reports 9 cases (before 1870) in which this operation was done on one or both sides, with slight improvement in 3.

Ligature of the lingual arteries in inoperable cases is advised by many writers (Küster), and is claimed to diminish notably the rapidity of growth; I have no personal knowledge of the efficacy of this procedure.

Hygiene of the mouth and the insufflation of powders containing borax, iodoform or morphine, and the use of cocaine in solution, and packing with iodoform gauze, have all been recommended as effective measures of relieving pain and fetor.

In some cases the Röntgen rays seem to have a restraining influence on the glandular growth, but the successful cases reported in literature are few and unconvincing. In two cases in which this treatment was tried by the reporter, the glands softened and an enormous ulcer formed, covering the neck from jaw to clavicle. Radiotherapy has, however, achieved a certain success in some of the milder forms of the disease. De Beurmann reports a case of leucoplakia followed by a tubular epithelioma which disappeared under treatment by Röntgen rays, but the case was too recent for a definite result. Others report favorable cases similar to this, but the general experience seems to be that in the more active form of epithelioma the lobulated or nest-cell containing type, temporary improvement is followed by a sudden exacerbation of the disease, and this latter type is, as we have seen, by far the most common form of epithelioma.

The action of *radium* on epithelioma of the mucous membranes has been well tested by Abbe. He has used this remedy in 8 inoperable cases of cancer of the tongue, and concludes that it is as distinctly beneficial at the start, as in epithelioma of the skin, but that in no advanced cases of the disease when it has invaded the muscle of the tongue has it yet been finally curative. In three cases of growths in every way resembling epithelioma, but occupying as yet only the superficial layers, a rapid and easy cure has followed.

He concludes that from our present experience we can expect a cure in the early stage of cancer only, but that further study may reveal that a more correct estimate of the amount

of the dosage of radium application or some improved method of using it will give finer results, even in advanced cases.

The conclusions which we may derive from a review of the literature and an analysis of these statistics of cancer of the mouth and tongue are as follows:

1. The relation of the lymphatic system to the primary growth is the most important anatomical consideration in operations for cancer of the mouth and tongue.

2. Chronic inflammatory processes of the mucous membrane which do not yield promptly to local treatment, are of importance as predisposing or precancerous conditions, and should be treated surgically.

3. Cancer of the mouth and tongue is a local disease limited to the tissues immediately surrounding its point of origin, and to the adjacent lymphatic system. Internal metastases are rare.

4. Microscopical examination of the primary growth should be made the crucial test of diagnosis in doubtful cases, and should be done preferably at the time of the operation. Antisyphilitic treatment is not a sure guide, and should not cause delay in surgical interference.

5. The modern operative treatment of cancer of the mouth and tongue involves:

a. Preliminary treatment of the cavity of the mouth;

b. Protection of the respiratory tract by drugs, and by intubation of the pharynx, or laryngotomy, or by position;

c. Removal of the primary lesion with a margin of one inch, if possible, of healthy tissue;

d. Block dissection of the lymphatic bearing tissues of the anterior cervical triangle, on one or on both sides as a routine measure;

e. A lower operative mortality may be obtained by performing the block dissection of the neck as a secondary operation about two weeks after the excision of the primary disease;

f. The intrabuccal operation is inadequate to reach the entire operation field, and should be supplemented by a dissection of one or both anterior cervical triangles:

g. The submaxillary route, although it permits a block dissection, does not give as free access to the diseased tissues as is demanded in an operation for cancer;

h. The route through the jaw exposes the whole field of operation, and enables the surgeon to act as if operating upon the surface of the body, but division of the lower jaw as at present performed adds greatly to the surgical risk.

6. The ideal operation of the future should contemplate a free exposure of the mouth and anterior cervical triangles as one continuous area, with a block dissection of its diseased contents. The use of mechanical devices for protection of the respiratory tract, and the perfection of technical details of the operation, along the lines already suggested, should enable us to perform an operation of this character without incurring the large mortality which is now to be expected.

7. The mortality varies with the extent of the operation, and is lowest (5 per cent.) with the intrabuccal operation, and highest (30–35 per cent.) in the operations involving division or resection of the lower jaw. Death is, as a rule, attributable to shock, sepsis or bronchopneumonia.

8. In a series of cases taken consecutively from the records of the Massachusetts General Hospital, 112 operations upon cancer of the tongue and mouth, resulted in 16 cases free from recurrence over 3 years after operation (14.2 per cent.) (all supported by pathological examination of the tissue).

9. Of 57 cases of cancer of the tongue, 10, or 17.5 per cent., were cured by operation.

10. Local recurrence of the disease occurred more frequently than recurrence in the lymphatic glands alone. In only one case did recurrence make its appearance at a period of more than three years after operation.

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A METHOD OF OPERATION IN EXTENSIVE CANCEROUS GROWTHS OF THE CHEEK INVOLVING THE JAW.*

BY LUCIUS W. HOTCHKISS, M.D.,

OF NEW YORK,

Surgeon to Bellevue and Junior Surgeon to Roosevelt Hospital. Associate in Clinical Surgery, College of Physicians and Surgeons.

PRIMARY cancer of the mucous membrane of the cheek is a rare disease. Beginning often as a small ulcer at the site of an abrasion, or caused, perhaps, by the irritation of the sharp edge of a carious tooth, it spreads more or less rapidly, until it finally involves the whole thickness of the cheek. Laterally, it spreads to and involves the alveolar processes of one or both jaws, the hard palate, sometimes the floor of the mouth, and may extend backward to the pillar of the fauces and tonsil.

In the early stages it may not give rise to much pain, but sooner or later it is apt to take on the character of a rapidly spreading septic inflammation of the cheek, causing great pain, as soon as the branches of the fifth nerve are implicated, and trismus from spasm and infiltration of the Masseter muscle. If seen at this stage, and the previous history is not carefully enquired into, the real nature of the condition may pass, for a time at least, entirely unsuspected. When the outer skin of the cheek becomes involved in the extension of the growth, perforation and the formation of a foul ulcer communicating with the mouth rapidly follows and the wretched patient worn out by the pain, and loss of sleep, and partial starvation on account of the difficulty in mastication and swallowing, rapidly looses ground, and dies of exhaustion and sepsis, unless his sufferings are more rapidly ended by the development of an intercurrent pneumonia.

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* Read at a meeting of the Society of Alumni of Bellevue Hospital, New York, March 2, 1908.

Curiously enough, glandular involvement of the tributary lymphatics is not necessarily deep nor extensive, even in advanced cases, as instanced in my own, and internal metastases may not be present at any time. It is this astonishing fact alone which gives us courage to attack these apparently hopeless cases by radical surgery, in the hope of affording even a lasting relief in some of them.

The magnificent work of Crile, in a large series of operations for the removal of extensive cancerous growths of the neck and face, by a block removal of all the affected tissues, whether bone, or soft tissue, after a temporary closure of the common carotid artery by his special clamp, points the way to results supposed hitherto to be unattainable.

A statistical paper [1] of great value, published last year by Anton Meller in the Zeitschrift für Krebsforschung, 1907, 16, 64, gives the results of a careful study of epithelial carcinoma of the head and neck, based upon the review of 327 cases of epithelioma observed in Hochenegg's clinic in Vienna, between the years 1894 and 1904.

The accumulated figures obtained from the study of such a great number of cases cannot help but be useful, and in this special instance, stimulating. It should serve also to correct various erroneous impressions which exist and which may have been derived from an unfortunate personal experience or from too hasty generalization based upon insufficient observation.

The results of the operation in this great series of cases are most interesting and suggestive. For example, it was found that in 50 per cent. of them, there was no recurrence after operation, within the three-year period, and of those cases which were operated on for recurrence, 21 per cent. remained free. Meller found moreover, that recurrence when it did occur was most often local, rather than in the glands, and that internal metastases had rarely occurred before the patients came to operation.

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[1] Zur Statistik der Hautcarcinome des Kopfes und Halses.

He found also that cancers in certain regions were more dangerous as regards glandular metastasis than in others; for instance, in the case of the lower lip, this involvement was found in 90 per cent. of all of them, while in cancer of other parts of the head and face, gland involvement was observed in but 18 per cent. to 43 per cent. It was found moreover, that the removal of infected glands up to the size of a pea or walnut, always gave good results when they only occurred in small groups or singly, but in those cases where the glands could be followed down to the clavicle, others would usually be found in the mediastinum.

Finally it was found that in really "inoperable" cases, an operation materially hastened the end by hastening extension along the opened up channels and mutilated tissues; and Meller declares boldly that similar bad results often follow rough attempts at removal of perfectly operable growths by inexpert operators in this field of work; which statement is borne out by the observations of most surgeons.

During the past year, three cases of extensive epithelioma of the inner lining of the cheek and involving the jaw, have come under my care, and the condition in all of them was so distressing that an extensive mutilating and dangerous operation seemed justifiable as a measure of relief, even though the chances of a radical cure seemed somewhat problematical. The experience gained in my attempts to effect the removal *en bloc* of all the visibly infected tissues, whether bone, muscle or skin, in an orderly and comparatively bloodless manner, may not be without interest to those of you who may be called upon to advise or operate in similar cases.

In the first case, operated upon in June, 1907, at the Roosevelt Hospital, much valuable experience was gained, and an operative technic developed which was useful in the later cases which form the basis of this paper. Operative recovery resulted in this, as in the other cases, but recurrence at the site of the scar took place within two months, which, on account of the patient's age (65) and rather feeble condition, was not subjected to further operation, and he died

of exhaustion in about four months from the time of the operation. In this case a large piece of the cheek and nearly one-half the lower jaw were removed, and the defect was closed in by a plastic flap taken from the skin of the neck. The growth in this first case was more closely localized to the mucous membrane of the cheek and the alveolar process of the lower jaw than in the later cases, and in a younger and more vigorous subject, an operation would doubtless have given more lasting results.

In the two cases which form the real basis of this paper, and in which the steps of the operation to be described were developed, the growth had involved a very wide area, as will be seen, and while too short a time has elapsed to predicate the ultimate result, the writer feels that as recurrence at the site is more probable in these cases than at a distance, and with the hope that it may be perfectly feasible to deal with such recurrence in the event of its appearance, the operation is not only a justifiable procedure, but really a desirable one even if it affords only a respite from the suffering that these unfortunates are obliged to undergo.

Both cases are alive and well at the end of about three months, and both are steadily gaining weight, the first one having gained about twenty pounds and the second about ten pounds.

The following is a review of the history of these two cases:

CASE I. Francesco de G., Italy, age 43, M., ragpicker. Admitted to Bellevue Hospital, January 6, 1908. In America five years. Irregular habits as to eating, drinking, and sleeping. Moderately alcoholic. Smokes and chews tobacco. Syphilis, doubtful. Generally in good health. Family history negative.

Present Condition.—About a year before a small "pimple" appeared upon the inner surface of the left cheek and was cut out by a physician, but never healed. The growth in the mouth began to ulcerate and to extend laterally and in depth, until the cheek was perforated about three months ago, since when his condition has become more and more wretched. There is no

history of injury to the jaw but the teeth have always been bad he says, though those adjacent to the growth had never troubled him and appear to be sound.

Examination revealed an ulcer involving the whole thickness of the left cheek about the size of a silver half dollar, its centre opposite the 2nd molar tooth, its edges hard, irregular in outline and undermined, and the surrounding tissues widely infiltrated. There is a very foul smelling discharge from the ulcer and it is mixed with the saliva which is very abundant and very offensive. The pain extending up into the head is very distressing and sleep without opiates is impossible. There is spasm of the Masseter muscle with marked trismus, and it is difficult to pry open his jaw, even a little, to examine the inside of the cheek and determine the extent of the growth. The patient is beginning to emaciate and is rapidly losing strength. His feeding is limited to fluids, part of which are lost through the large whole in the cheek.

The lymphatic glands below the jaw are considerably enlarged and adherent to the skin and each other, but do not extend very far down the side of the neck, *i.e.*, apparently not below the level of the cricoid cartilage.

Examination of a section of the edge of the ulcer, shows it to be epithelioma. The patient has been refused operation at two hospitals, but, in view of his age, 43, and the comparatively small glandular metastasis, as well as of his urgent prayer for relief from his wretched condition, the operation was undertaken on January 11, 1908.

Case 2. Walter T., U. S., laborer, 52 admitted to Bellevue Hospital 1–1–'08. Family and previous history, negative. Generally in good health, moderately alcoholic, smokes and chews tobacco, pretty steady pipe smoker and in the habit of tucking his pipe into the right angle of the mouth, *i.e.*, on the affected side. His trouble began five months before with a small ulcer in the mucous membrane of the right cheek at a point which was constantly irritated by being caught between his teeth. The ulcer increased in size, slowly at first, but lately the whole cheek has become involved in what seemed to him an inflammatory process. Six weeks before he began to suffer from pain of increasing severity, which pain was in the cheek and extended up into the head and lately it had become so

severe that he could not sleep, and an increasing stiffness in the movements of the lower jaw had rendered eating a painful and unsatisfactory process.

Examination shows a deep ulceration of the mucous membrane of the right cheek about opposite the second molar tooth, and extending to the alveolar process and backward to an extent undetermined on account of the inability to pry open the mouth wide enough to get a better view. The lymphatic glands in the submaxillary region were enlarged, very hard, but were not adherent to the skin nor did they extend far down the side of the neck.

The heart and lungs are normal and there is no evidence of internal metastasis. Section from the growth shows it to be epitheliomatous, and an operation was advised. During his stay in the hospital his condition became more unbearable and the growth increased in extent until the cheek was finally perforated the day before the operation, which was done January 20, 1908.

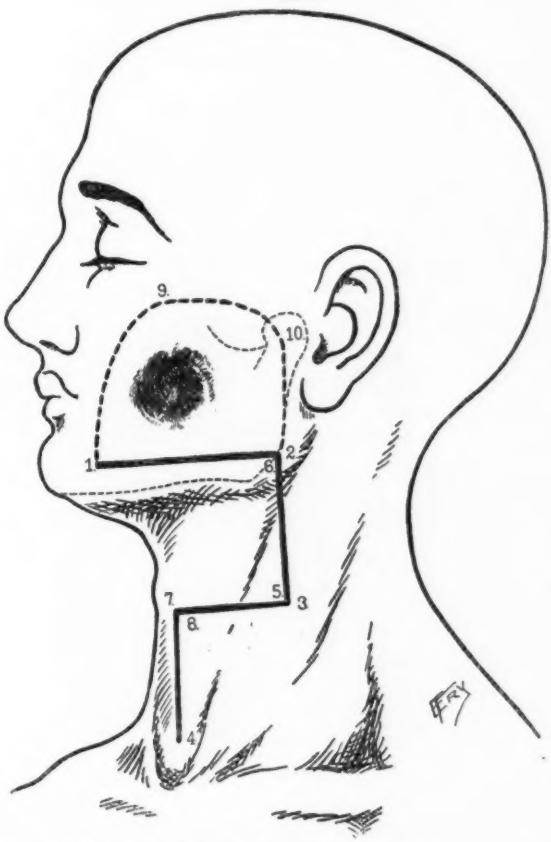
Both cases, it will be noticed, were comparatively young men, and, while their condition was far from promising, they both willingly submitted to operation. As the tissues of the cheek were very widely involved in both cases, necessitating a wide opening into the cavity of the mouth, it became evident that some form of plastic operation would have to be devised, which would provide for the immediate closure of this gap, provided it would not add materially to the length and danger of the procedure.

With this in view, a plan of operative attack was worked out by which the growth in the cheek and jaw could be removed, together with the infected tributary lymph-nodes in the neck, in one piece, from below upward, with the least possible shock and hemorrhage, and the hole in the cheek rapidly closed by a plastic flap taken from the neck and turned back in the course of the exposure of the cervical lymph-glands to be removed.

Description of the Operation.—An incision (1, 2, 3, 8, 4—see Fig. 1.) was made through the skin, and the flap 1, 2, 3, 8, was turned forward toward the median line, exposing the lower border of the inferior maxilla, the platysma overlying the submaxillary gland, and the deep structures of the neck.

The sternomastoid muscle was freed along its anterior border, thus exposing the chain of enlarged glands extending from the submaxillary space to below the level of the cricoid cartilage. Beginning below, the entire chain of lymphatic glands along the internal jugular vein and beneath the sternomastoid

FIG. 1.

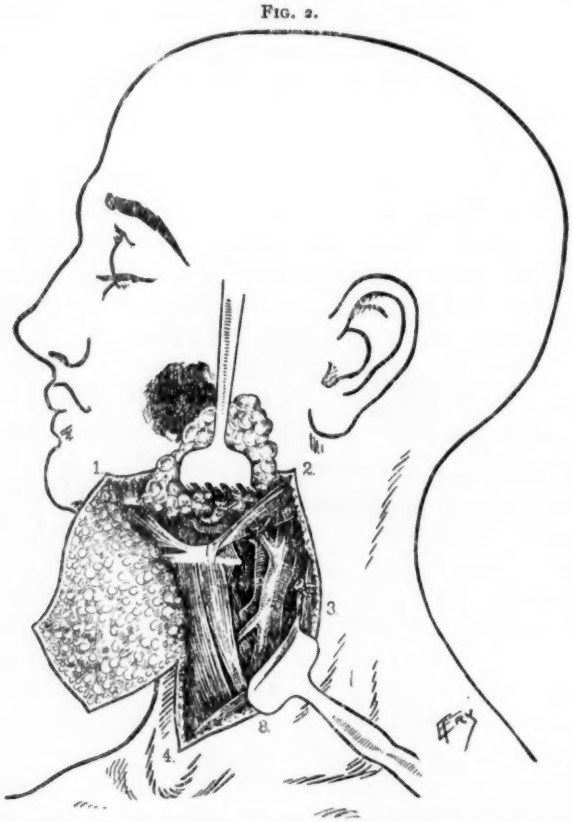


The heavy lines mark the outline of the flap from neck to cover defect left in cheek, portion circumscribed by dotted line.

muscle was removed, together with any periglandular fat that might be adherent to them, in one piece, from below upward, until the bellies of the digastric came into view, and then the contents of the submaxillary space both the salivary and the lymphatic glands were shelled out cleanly and retracted upward in one piece. The external jugular and facial veins were ligated

and divided, and the external carotid artery was isolated and divided between ligatures of chromic gut, just above the origin of the superior thyroid branch. The outer surface of the lower jaw having been exposed and cleaned ready for section, and the neck-wound protected by gauze packing, the skin of the face was

FIG. 2.

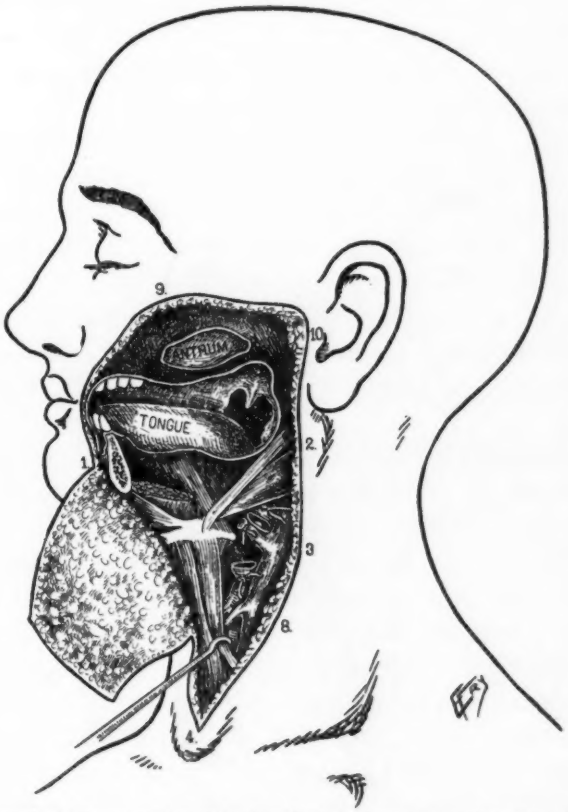


Skin flaps retracted, showing exposure obtained. Deep glands dissected up and extracted. External carotid ligated.

divided in such a manner as to widely circumscribe the growth along line 1, 9, 10, 2 (Fig. 1.) and the mouth rapidly entered. The jaw was then divided with a gigli saw through the socket of the canine tooth, the extent of the growth within the mouth being now plainly visible. When the cut end of the jaw was retracted, incisions through the mucous membrane well clear of the growth were made.

The mucous membranes and structures of the cheek were divided along the alveolar margin of the upper jaw, back to the molars and the floor of the mouth was divided along the groove of the tongue. This severed the mylohyoid and the hyoglossus muscles. The inferior maxilla and attached struc-

FIG. 3.



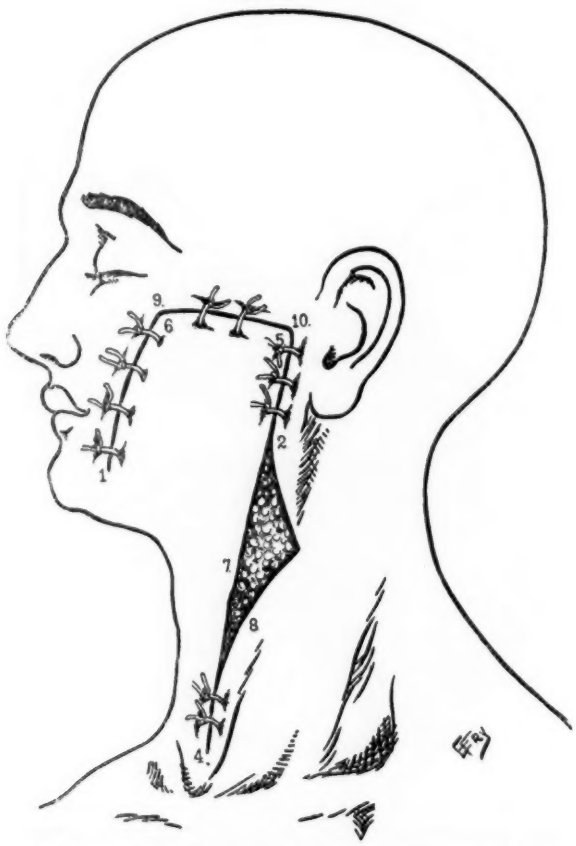
Tumor removed with large portion of cheek and ½ the lower jaw and portion of upper jaw. Cavity of mouth opened.

tures were then retracted outward, and, as the growth, in Case 2; was found to involve the posterior border of the alveolar process of the upper jaw and hard palate. The alveolar process of that bone was removed with a chisel from as far forward as the canine tooth and with it, the floor of the antrum, the pyramidal process of the palate bone, the lower end of the internal pterygoid plate, with hamular process, the lower end

of the external pterygoid plate, and a portion of the malar bone (see Figs. 2 and 3.). Upon disarticulating the inferior maxilla rather sharp venous oozing ensued, but was easily controlled by gauze packing.

To close up the large defect left in the cheek, the mucous

FIG. 4.



Plastic flap from neck sketched in place covering defect in cheek.

membrane at the side of the tongue was united to the cut edge of the hard palate, the tongue thus being elevated as a sort of wedge against leakage from the mouth. The edges of the cut mucous membrane in front and behind this were united by suture, and the cut edge of the mylohyoid muscle was brought up over this line of union of the mucous membrane, and the skin

flap shown in figure 4 was then sutured up to fill in the defect in the cheek. A portion of the incision in the neck was left unsutured and filled with loose gauze packing extending up to the glenoid and temporal fossa, and this packing was left in place for several days until granulation was established.

The essential features of the operation are rapid, clean dissection with a sharp knife, careful retraction to avoid bruising of the tissues, isolation and removal of all the glands and infected fat in the area tributary to the growth, preferably from below upward, and with the least possible handling, ligation of the external carotid artery or temporary compression of the common carotid, after the method of Crile, stopping all bleeding, and finishing the work in the neck and clearing the jaw before the cavity of the mouth is entered, then rapidly removing the tumor, skin, bone, and infected glands, *en bloc,* and completing the operation as soon as possible by stitching the plastic flap into place and providing for drainage and suture of the neck.

The use of the tongue as a barrier to help close in the defect in the cheek is practical and tends to diminish the chances of early leakage from the mouth. The patients are bolstered up in bed as soon as out of ether and set up in a chair the second day if possible. Feeding through a tube passed through the nose becomes a necessity during the first few days after operation, especially if the rectum is intolerant, and allows healing to take place with the minimum of leakage and infection. Moderate infection occurred in both cases, but was not ever a serious factor. Some sloughing of the flap occurred in the first case, as it had to be shaved very thin by reason of the subcutaneous cancerous involvement, and the skin defect remains in cheek. In the second case, the flap was very effectual, although there are still one or two small points, rapidly closing in, where slight leakage from the mouth has occurred. Both patients are entirely relieved of their pain and both can eat solid food with comfort.

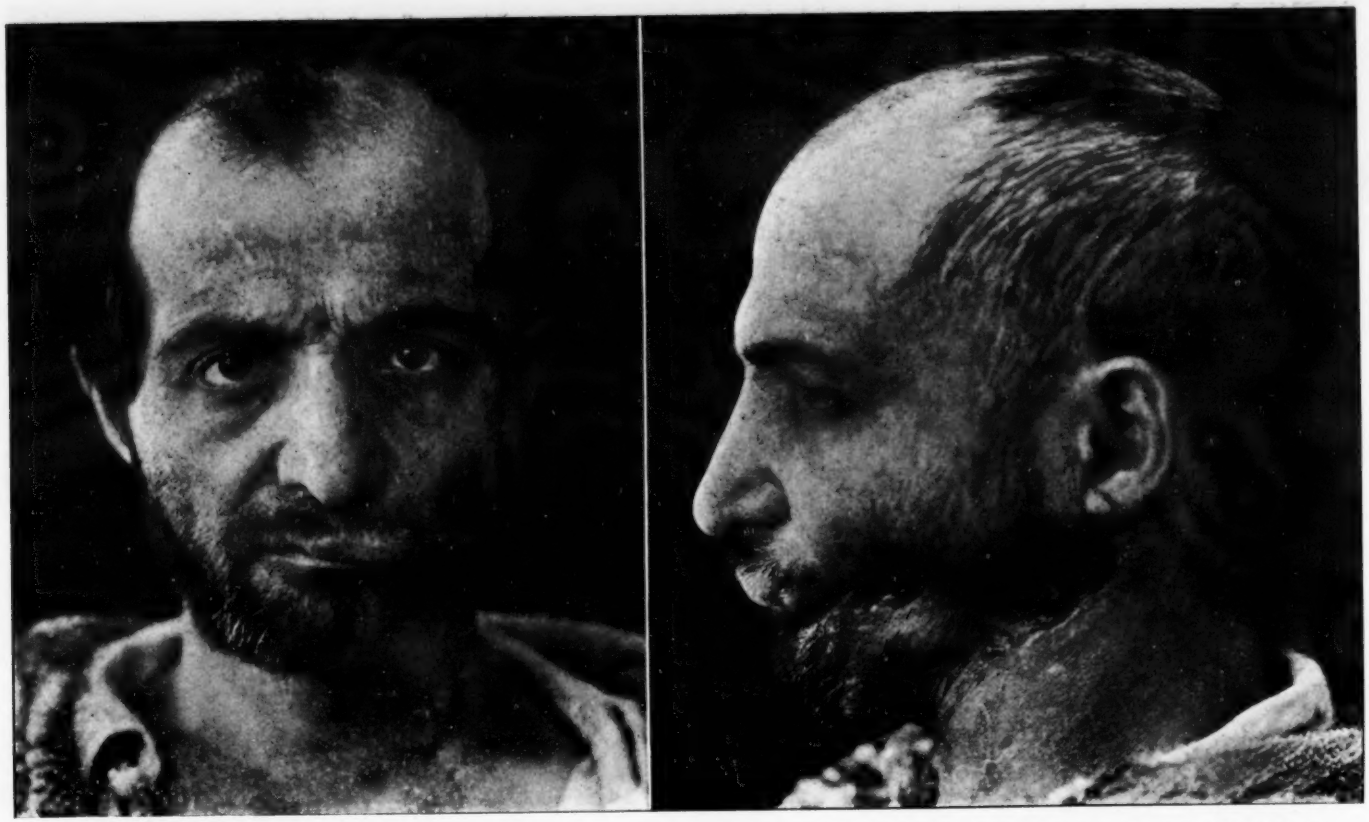
This operation, as described, is offered as an available method of attacking extensive growths of the cheek and jaw, the removal of which necessitates a wide opening into the cavity of the mouth, and in which it may seem best to do the operation in a single sitting instead of in two stages.

It is original, in so far that the writer has never seen it done or described, but in this day of surgical progress one hesitates to call any operation a new one.

The photographs were taken before the complete healing of the wounds and are offered merely to show the general outline of the plastic flap, and the deformity resulting from so extensive an operation. It will be noticed in the photograph of Case 2, that the cosmetic result is much the better, although the bone removal was much more extensive, possibly because the lower jaw was sawn farther from the median line in this case, thus preserving the outline of the chin.

At the end of three months there is a slight local recurrence in the upper edge of the cheek opening in Case 1 which will be promptly removed. In Case 2 there are no evidences of recurrence. Both cases have enjoyed a period of complete respite from their sufferings, and both appear to be in good physical condition.

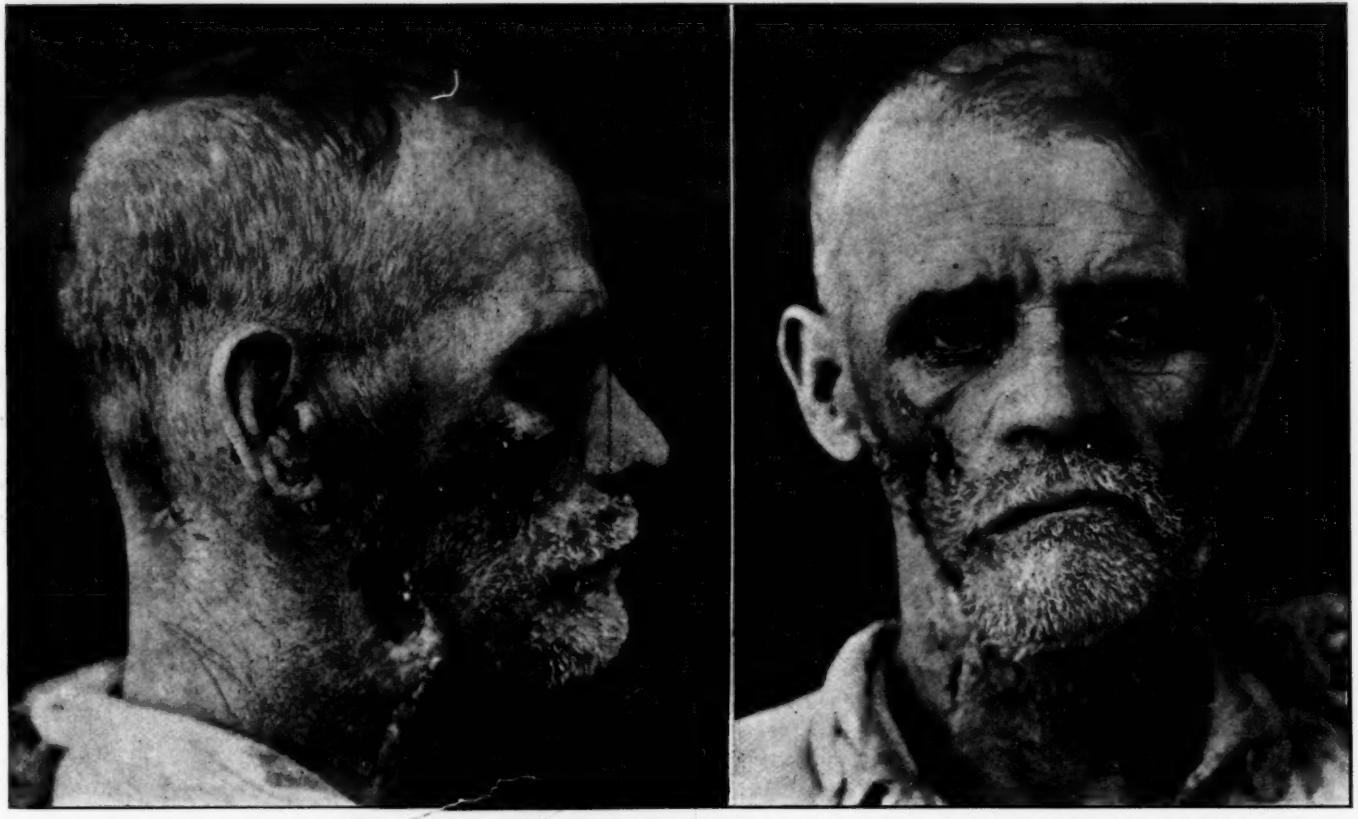
FIG. 5.



Front view, showing deformity about 3 weeks after operation.

Side view, showing plastic flap with partial neurosis of upper edge and angle.

FIG. 6.



Side view, showing plastic flap in place, healing nearly perfect 2 weeks after operation.

Front view, showing the temporatively slight deformity.

RECURRENCE AT A LATE PERIOD AFTER OPERATION FOR CANCER OF THE BREAST.

BY WILLIAM M. MASTIN, M.D.,

OF MOBILE, ALABAMA.

In view of the renewed interest manifested in the end-results after operation for carcinoma of the breast that has appeared in recent surgical literature, and especially as shown by the symposium of papers on this subject read at the last meeting (1907) of the American Surgical Association, the herewith reported case of very late recurrence is interesting.

Although Volkman's three-year period as a limit of safety after operation for carcinoma can no longer be accepted as a positive law, yet it must be conceded that a very large percentage of cases remaining well up to this limit are apt to continue on with freedom from recurrent disease. And statistics further demonstrate that with each succeeding year after this triennium period the fewer are the recurrences, until finally when the first decade is passed the number becomes so small as to warrant being considered as rare.

Among the symposium of papers mentioned, Joseph Ransohoff discussed the subject of very late recurrence after operation, and showed that of a small series of cases of late recurrence (after six years) he had collected, 10 occurred during the seventh and eighth years, 2 each after the ninth, tenth, eleventh, twelfth and fifteenth years, and 1 each after intervals varying from fifteen to twenty-five years.

At the same meeting, W. B. Coley reported 65 cases of recurrent cancer, of which 10 (15 per cent.) recurred after three years, and 4 (6 per cent.) after fourteen years. Of the latter number the longest duration was seventeen years.

But the very pertinent question has been asked whether these so-called late recurrences are actual recurrences or rather

new deposits or secondary growths in persons manifesting a cancerous predisposition. And along the same line, that such recurrence taking place in the scar at a distance from the location of the primary growth should be regarded as possibly a carcinomatous degeneration of cicatricial tissue. In substantiation of this view it has been shown that in some of these cases the histological type of the secondary or recurrent growth does not correspond to that of the original tumor,—presenting the features of both epithelial and connective-tissue growth. This, as has been stated, offers another point for thought, for it is reasonable to assume that a true recurrent growth should exactly correspond histologically to the primary tumor formation.

The incompleteness of the history of the subjoined case renders it quite impossible to assert whether the histological requirements exist or not. Again, the length of time the primary growth existed without involvement of the axillary glands, would cast a reasonable doubt upon the correctness of the original diagnosis, and suggest carcinomatous degeneration of cicatricial tissue. But, on the other hand, the pathological report of carcinoma from a competent source, the presence of a cancerous nodule in the very near vicinity of the primary focus, together with the absence of metastases either in the axillary lymphatics, or elsewhere in the viscera, place it properly, I believe, in the class of late recurrence as now recognized.

Carcinoma of the left mamma; excision three years after appearance; recurrence seventeen years and eight months after operation.

A Sister of Charity, of the Order of St. Vincent de Paul, at the age of 50 years, had the left breast removed for carcinoma, by a prominent surgeon of St. Louis, in November, 1885. Microscopic examination confirmed the diagnosis.

From the appearance of the cicatrix, which is horizontal in direction, five inches long, and does not extend to the arm-pit, the operation was evidently a simple excision of the gland without invading the axillary space.

The patient states that the tumor growth was situated in the inner and lower quadrant of the breast, was painful and sensitive, had attained the dimensions of a walnut when extirpated, and was attributed to a violent blow received by coming in contact with the sharp edge of a door three years before. The lump appeared about two months after the injury, and was of slow growth. There was no axillary lymph-node involvement. The operation wound healed by primary union, and there was no evidence of recurrence of the neoplasm until the summer of 1903, a period of seventeen years and eight months from the date of operation. At this time she discovered a small nodule in the skin at the sternal end of the scar, which was tender and painful.

The present examination (September, 1907) discloses a stony-hard, irregularly roundish, movable mass, two inches and a quarter in diameter, occupying the inner angle of the cicatrix. Sharp, radiating pains are complained of, and palpation of the parts is decidedly painful. The inner third of the scar is depressed and firmly adherent to the growth, while the outer two-thirds are soft and free from attachments. The axillary glands are not palpable. A large mole, ovoid in shape, elevated, and of a pale yellow-pink color is located in the skin an inch above the outer side of the scar. This is dry not ulcerated, although the patient asserts that it occasionally exudes a slight serous fluid, and has largely increased in size during the last three years. There are no metastases and the recurrence seems to be entirely *in loco*, but there has been a slight rise of temperature in the evening—99 to 99½ degrees—for several weeks. She is fleshy and well-nourished, and regards herself as strong and in excellent health considering her advanced age of passed three score and ten years. She has recently undergone a successful cataract extraction on the right eye. Further operation was refused.

OSTEOPLASTIC RESECTION OF THE COSTAL ARCH, FOLLOWED BY RESECTION OF LESSER CURVATURE OF STOMACH AND ŒSOPHAGUS, AND ŒSOPHAGOSTOMY.*

BY JOSEPH WIENER, M.D.,

OF NEW YORK,

Adjunct Surgeon, Mt. Sinai Hospital.

OWING to their extreme inacessibility, largely due to the unyielding character of the chest wall, malignant tumors of the cardia and lower end of the œsophagus have until quite recently been considered a *noli me tangere*. True, these lesions are fortunately not common. Osler and McCrae in a series of 150 consecutive cases of carcinoma of the stomach found only two such cases.

Micheli, in a report to the Tenth Italian Congress of Surgeons in 1895, seems to have been the first to have worked out a definite operation for exposing the lower end of the œsophagus. He proposed and carried out on the cadaver, but never on the living subject, a thoracoplasty whereby a flap was raised, including the lower end of the chest wall, together with the diaphragm and parietal peritoneum. The operation would seem to be a very serious one, with considerable danger of injuring the pleura. Gottstein, in 1901, referred to two operations done by Mikulicz. In the first case he carried out a procedure similar to Micheli's. In his later case he made a median abdominal incision and several transverse incisions through which he divided the seventh, eighth and ninth ribs. Both of these patients of Mikulicz died from the effects of the operation, as in each case an extensive resection of the stomach was done.

* Read before the Surgical Section of the N. Y. Academy of Medicine, May, 1908.

Kelling, in 1901, after referring to an operation suggested by Lannelongue which he considers too mutilating (especially as we cannot at the start be sure that we will be able to do a radical operation), suggests a special posture for operations at the vault of the diaphragm. The head and trunk are to be on a table slightly elevated and the lower extremities hang vertically down over the end of the table with the feet resting on a pillow on the floor. This posture is similar to that used by anatomists in dissections of the diaphragm. A strap holds the trunk of the patient on the table; the leg holders are turned down and the patient is fastened with the spine bent in the dorsal and lumbar region. An incision is made in the median line and a second incision at a right angle extending to the tip of the twelfth rib. One of the objections to the posture is the difficulty in keeping the intestines within the abdomen, and a further objection is the difficulty in maintaining asepsis. The posture was not a practical one, and this led Kelling to modify it in an article published in 1904. In this article he recommends a pseudo hip-rest which is applied to the region of the diaphragm or liver. We have for several years been using a table at Mount Sinai Hospital which enables us by turning a handle to break the table into two inclined planes. In this way a deeply-seated gall-bladder or common duct or stomach, is made much more accessible. Dr. Howard Lilienthal devised a similar portable table in 1903.

Marwedel, in 1903, described an incision for osteoplastic resection of the chest. He claimed for his incision that it was less complicated and less dangerous than those referred to above. He makes only one abdominal incision. It begins at the ensiform and runs parallel to the free border of the ribs and 3 cm. from it, and extends to about the tenth rib. The seventh costal cartilage is divided close to the sternum. By blunt dissection the seventh, eighth and ninth ribs are laid free and divided close to the junction of the cartilaginous and bony portions. In this way a freely movable flap is obtained, and the exposure is surprisingly good. If necessary the sixth costal cartilage could also be divided. Beginning with the

seventh rib care must be taken not to injure the pleura. Towards the median line it is only necessary to divide the seventh rib, as the lower ribs do not reach the sternum. Marwedel performed the operation in a case of stenosis and spindle-shaped distention of the œsophagus due to cardiospasm. At the operation he found the stenosis above the diaphragm and was unable to do the plastic operation which he had planned.

Asthoewer, writing in 1903, referred to a case which he had operated on in 1894 through an incision similar to that described by Marwedel. The first incision was exploratory, at the outer border of the left rectus; this was enlarged upward to the free border. A second incision was made at right angles to the first, reaching to the tip of the eleventh rib, and a third incision parallel to the first extended from the eleventh rib upwards. The eighth, ninth and tenth ribs were divided as well as the costal cartilages of the seventh and eighth ribs close to the sternum. Through this incision a multiple fibroma of the spleen weighing seven pounds was removed. The patient died in twenty-four hours. In another case, operated on in 1902, Asthoewer made a somewhat similar incision in an attempt to remove a sarcoma originating in the ribs on the left side. The tumor turned out to be inoperable, and the patient died seventeen days after operation. Asthoewer points out that in some cases the costal arch is so broad and nonresisting that the osteoplastic operation may be unnecessary. On the other hand, with a narrow costal arch the resection within the limit of the cartilaginous portion of the ribs will not give good access to the dome of the diaphragm. And if we resect the ribs beyond the cartilaginous portion, we run the risk of injuring the diaphragm.

Willy Meyer, in 1906, reported two cases in which he had resorted to an osteoplastic resection of the costal arch.

The first case was that of "a boy 14 years of age who had an absolutely impermeable cicatricial stricture of the œsophagus (caustic lye). For eight years he had been fed entirely through a gastric fistula. All attempts to enter the stomach from above as well as under direct inspection with

the urethral speculum introduced through an œsophageal lip fistula in the neck having failed, an osteoplastic flap was raised by a V-shaped incision, the water-tight gastric fistula being carefully preserved. A part of the anterior wall of the stomach, well above the fistula, was thus reached, horizontally incised, and the passage upward searched for from below. To my great disappointment this attempt, too, proved unsuccessful. The œsophagus was evidently obliterated for some distance. The stomach incision was therefore closed again by means of a double row of Lembert silk sutures; the osteoplastic flap was fitted back in its place and the skin sutured; there was no drainage. The boy made a good recovery."

Willy Meyer's second case was one of multiple sarcoma of spleen. The abdomen was opened through a median incision; to this was added a transverse incision extending to the tip of the eleventh rib. The costal cartilages were exposed by blunt dissection. The seventh cartilage was divided close to its sternal attachment, then the seventh, eighth, ninth and tenth cartilages were divided near their junction with the ribs. This gave such excellent exposure that the large spleen was easily removed. The tumor proved to be a metastatic, small, round-celled sarcoma. The man made an operative recovery, but died suddenly of internal metastases ten weeks after operation. The autopsy showed good union of all the costal cartilages.

The author's case differed in several respects from those previously reported. The osteoplastic resection of the costal arch was done to accomplish a resection of the lesser curvature of the stomach and lower end of the œsophagus. The operation was done in two stages; thirty days elapsed between the osteoplastic resection and the resection of the stomach and œsophagus.

Sarah S., Russian, 45 years old, was admitted to Dr. Lilienthal's service June 28, 1907 and came under the writer's care. Both parents had died of pulmonary disease presumably tubercular. With the exception of measles in childhood, the patient had always been well. She had been married 25 years, had had seven children and no miscarriages. Although she had been complaining of her stomach for ten years, she had only been vomiting for three months prior to her admission. During this time she had been vomiting small quantities almost daily, but only after eating. She had never vomited large quantities but there was frequent eructation of gas. She had often complained of slight pain and uncomfortable sensations in the left epigastric region. Constipation was marked and the patient had lost considerable

flesh. No fever or jaundice had been noted. The chief complaints were vomiting and loss of weight.

Physical examination: General condition good, fairly well nourished. Tongue clean and moist, teeth and gums in poor condition. There were no palpable glands. The heart and lungs were normal, the abdomen adipose, large and flabby. There was no abdominal rigidity but slight tenderness in the epigastrium on deep pressure. No mass was palpable either in the supine or in the knee-chest position. The liver was not enlarged to percussion, nor was it palpable below the free border of the ribs. The spleen was not enlarged. Vaginal examination showed a moderately enlarged uterus. Rectal examination was negative. A test meal showed the presence of lactic acid and the absence of free hydrochloric acid. Dr. G. A. Friedman who referred the case to the hospital deserves the credit of having made the diagnosis of carcinoma of the lesser curvature of the stomach.

Operation July 1, 1907: *Exploratory Cœliotomy and Osteoplastic Resection of Chest Wall.* Gas and ether. The abdomen was opened through a four-inch median epigastric incision. A tumor was found involving the lesser curvature of the stomach and the cardia. The tumor was fairly movable, but could not be brought into the field of operation. It could be felt high up under the dome of the diaphragm but it could not be seen. An incision was then made parallel to the free border of the ribs on the left side connecting with the median incision. This incision was made with the view of doing an osteoplastic resection of the chest, as it was impossible to deliver the tumor into the wound or to tie off the gastrohepatic omentum. The seventh, eighth and ninth ribs were exposed by blunt dissection and the cartilages of the seventh and eighth ribs were divided close to the sternum. During this manipulation the pleura was injured and the opening at once closed by suture. There was a striking improvement in the exposure of the tumor. It could now be readily brought into the wound and freed from the gastrohepatic omentum by heavy catgut ligatures. An assistant meanwhile made firm traction on the left chest wall; so that whereas before the division of the costal cartilages no one taking part in the operation was able to see the tumor, we were now able to examine it carefully and study its relations to the surrounding tissues. Owing to the fact that the patient became very cyanotic and the pulse rapid and

feeble, it was deemed advisable to postpone further interference. Two gauze drains were inserted, one anterior and the other posterior to the tumor. The abdomen was closed with through and through silk sutures.

On the following day there was moderate subcutaneous emphysema of the chest wall. A day later the emphysema extended to both infra- and supraclavicular regions and upward on both sides of the neck. It then extended up over the left side of the face. The swelling produced by the emphysema was especially marked in the supraclavicular regions. On pressure the swelling could be very much reduced, but as soon as the pressure was removed, the swelling returned. It was not deemed safe to turn the patient to make a careful examination of the chest, but there were signs of air in the pleural cavity. Temperature, 102.4° F.; pulse, 138; respiration, 38.

On July 7th the emphysema had extended to both sides of the face as far as the orbital regions, so that the facial expression was that of a nephritic. However the patient did not suffer any inconvenience therefrom. She complained a great deal of cough especially at night. The first dressing showed the pleural opening closed and the wound clean. Two weeks after operation there was a moderate pyocyaneus infection of the wound. The emphysema had become less marked. The daily vomiting which had been present before operation, persisted. On July 19th the emphysema had disappeared entirely from the left side and only a little remained on the right side in the infraclavicular region. The pyocyaneus wound infection was much less marked. Owing to the persistent vomiting it was not possible to improve the general condition, and there was a steady loss of weight. This was of course to be expected as the tumor in the stomach had not yet been removed. We were thus forced to do the secondary operation under unfavorable conditions.

Operation July 31, 1907: *Partial Gastrectomy; Resection of Œsophagus; Gastro-œsophagostomy.* No general anæsthetic was administered. A spinal injection of stovaine was given and eucaine was used locally. The former wound was opened and extended downward 2½ inches. The general abdominal cavity was found well walled off by adhesions. The tumor was found to be in the lesser curvature of the stomach involving the lower end of the œsophagus. Some remaining strands of the gastro-

hepatic omentum were cut through and by means of blunt dissection and scissors the growth was isolated. A large V-shaped piece of the stomach, in the centre of which was the tumor, was excised, together with about 1¼ inches of the lower end of the œsophagus. The severed end of the stomach was caught with clamps and the field sponged dry of leaking gastric juice. Before cutting across the œsophagus two guide sutures of silk were passed into its wall to enable the pulling down of the cut end. The large opening in the stomach was closed with considerable difficulty owing to the adhesions from the previous operation. Several layers of Pagenstecher linen thread were used, the first one including all the coats of the stomach except the mucous membrane. After closing the opening completely, a new opening was made in the portion of the stomach nearest the severed end of the œsophagus. Into this small opening the end of the œsophagus was implanted and fastened in place with linen sutures. During the entire procedure the patient was fully conscious and did not complain of pain. She was now given a little water to see if the closure was perfect. Two points of leakage were seen and closed by suture. A packing was inserted down to the anastomosis, and the abdomen partly closed with through and through chromic gut sutures not including the skin. The specimen showed a growth 4 by 6 cm., very hard but showing no ulceration. Dr. Mandlebaum who made sections from the tumor pronounced it adenocarcinoma.

The immediate reaction from the operation was good. Nothing was given by mouth for seven days. Murphy infusion and stimulating enemata were well retained. Pulse and temperature were only slightly above normal during the first week following operation. During this time the wound discharge was very moderate and alkaline in reaction. On the eighth day a little water was given by mouth. The packings had been removed on the sixth day and fresh ones inserted. On the ninth day the patient drank water freely and it was noticed that there was a profuse watery discharge from the wound indicating leakage at the site of suture. On the eleventh day the condition suddenly became worse the pulse going up from 100 to 140 and the temperature from 99.6° to 104.4° F. Respiration became very much embarassed and cyanosis marked. In spite of active stimulation the patient died eleven days after operation.

Abstract of the Wound Examination by Dr. Libman.—The œsophagus had separated from the stomach by 2 cm., with sloughing at the free end. There was a large subphrenic abscess on the left side. The mediastinum and pleura were normal. There was no evidence of carcinoma, and no enlarged glands. There was fatty degeneration of the liver. The lungs showed passive congestion but no consolidation. A large healed cavity was found at the right apex. All of the stomach sutures had held and the suture line was water-tight.

So few operations of this kind have been done on the human subject that a careful analysis of each case is not only advisable but imperative. The shock of doing the entire operation under anæsthesia at one sitting is very great, and the resulting mortality would be too high. We have a choice of two alternatives, either we can do the operation under anæsthesia in two stages, or we can do one or both stages under spinal anæsthesia. Theoretically there is an objection to doing the operation at two sittings; adhesions that formed between the two steps of the operation might interfere with the secondary resection of the stomach. On the other hand the adhesions will partly wall off the rest of the peritoneal cavity and thus very much lessen the danger of a peritoneal infection. In our case we waited thirty days before doing the secondary operation, and although extensive adhesions had formed, they did not materially complicate the technic; and we had a feeling of security from the fact that the general cavity was partly shut off.

The first step in our operation was done under gas and ether; and the second step of the operation, the resection of stomach and œsophagus, under spinal anæsthesia. It was surprising how well the patient stood this second operation which took one and a half hours. During all this time she was fully conscious and was conversing with the operator and his assistants. At the close of the operation she declared she had had very little pain.

There is another advantage in using spinal anæsthesia. When we have completed our suturing of stomach and œsophagus the patient can be asked to swallow some water, and we can then detect any leak in the suture line. We took advan-

tage of this procedure in our case, and found two small openings in the suture line which were readily closed. And at the wound examination the suture line in the stomach was found water-tight.

A point in the technic of the utmost importance is the method of disposing of the open end of the œsophagus. If we resect an inch and a half or more of the œsophagus its cut end will not be covered by peritoneum. Even though we are able to bring down the œsophagus and suture it into the stomach without tension, the chance of getting a good union is minimized by the absence of peritoneum over the end of the œsophagus. In animal experimentation there is not so much difficulty in getting a good union between stomach and œsophagus. But in the human subject as is well known the success of all anastomoses in the gastro-intestinal tract depends on good union of the serous surfaces. Where the serosa is absent, as in the second portion of the duodenum and the lower portions of the rectum, we are very apt to have leakage. And that is what unfortunately happened in our case. Although we were able to bring down the cut end of the œsophagus and suture it without tension into the newly-made opening of the stomach which was drawn well up under the diaphragm, the sutures did not hold. There was leakage, followed by a subphrenic abscess, which caused the death of the patient. On the other hand every single suture employed in the wall of the stomach held securely for eleven days until the patient's death, because here we had good serosa in our suture line.

How else can we deal with the cut end of the œsophagus? We can sew it up completely and do a gastrostomy or a jejunostomy; or we can make an œsophageal fistula at the root of the neck, bringing out the cut end of the œsophagus and suturing it to the skin of the neck. This could, if necessary, be done at a subsequent sitting, thus dividing the operation into two or three steps. Had either of these methods of dealing with the end of the œsophagus been carried out in our case, we believe the patient would have had an excellent chance to re-

cover. So that this point in the technic is really of vital import.

The objection to closing the œsophagus completely is that fluids from the mouth would run down and cause trouble. This objection would be overcome by making an œsophageal fistula in the neck.

We do not wish to claim originality for this step but, so far as we have been able to search the literature, we have nowhere found this suggestion either made or carried out.

The steps of the complete operation, which could be divided into two or three sittings, would then be:

First Operation.—Osteoplastic resection of costal arch, either through an incision parallel to the free border of the ribs, or through a median and cross incision.

Second Operation.—Resection of stomach and œsophagus; and gastrostomy or jejunostomy.

Third Operation.—Œsophagostomy at the root of the neck.

The idea of doing an œsophagostomy instead of attempting to suture the œsophagus to the stomach occurred to the writer from its analogy to doing a colostomy after excision of the rectum. The writer is aware that Sauerbruch, in his animal experimentation, obtained better union between œsophagus and stomach by the button than by suture. His suture cases all leaked. However, we can hardly, in the human subject, expect to get a watertight, permanent union by the button. Indeed, judging from the use of the button in intestinal work, we could not expect as good results as from sutures.

Furthermore, at the present time, when even the question of doing intrathoracic operations under positive or negative pressure is still *sub judice,* the operation which the writer has suggested would seem to have a field of usefulness. And it must also be admitted that intrathoracic operations are much more shocking than intraperitoneal operations. And finally, if we determine not to bring down the œsophagus, we can resect it at a higher level and thus get further away from the diseased focus.

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NOTES ON THE ARREST OF HEPATIC HEMORRHAGE DUE TO TRAUMA.

BY J. HOGARTH PRINGLE, F.R.C.S.,

OF GLASGOW,

Lecturer on Surgery in Queen Margaret College, Surgeon to the Glasgow Royal Infirmary.

RUPTURE of the liver is fortunately an accident not often met with, but one which, when it is seen, may be associated with a condition of the patient as serious as any one can meet with in surgical practice. While small lacerations of the liver substance may be, and, no doubt are, recovered from without surgical interference; if the laceration be extensive and vessels of any magnitude are torn, hemorrhage will, owing to the structural arrangement of the liver, go on continuously, and by the time such a patient comes under the care of a surgeon the general state is almost invariably bound to be extremely grave, from the hemorrhage alone or from hemorrhage and shock combined, and this is perhaps specially the case in that class of injury due to contusing violence in which there is often gross injury inflicted on parts other than the liver and when shock is liable to be more severe than in localized injuries caused by sharp instruments.

The statistics collected by Terrier and Auvray show that wounds of the liver from contusing violence are much more fatal than localized cutting injuries for out of 44 patients operated upon for wounds of the liver caused by sharp instruments there were 7 deaths, whereas out of 23 patients operated on for wounds due to contusing violence there were 9 deaths.

During the last eleven years there have been eight patients admitted to my service at the Glasgow Royal Infirmary, who had sustained a rupture of the liver. Three of these patients suffering from the effects of gross traumatism died almost

immediately after admission to the hospital. Post-mortem examinations were made in these three cases, and in one of them it was found the liver had been torn completely into two halves along the longitudinal fissure; in another there was, in addition to an extensive laceration of the liver, a widespread fracturing of the base of the skull, with laceration of the brain and a fracture of the right femur. In the third, there was a dislocation of the knee along with fractures of the left fibula, right humerus and several of the right ribs, with a wound of the right lung as well as the liver injury. The condition of each of these patients was hopeless from the beginning. The other five patients survived their injury, so far as to enable an extended examination to be made, and on four occasions it was determined to open the abdomen upon the assumption that the patient had a rupture of the liver, in the hope that it might be possible to arrest the bleeding and perhaps save the patient, but the results were anything but gratifying, for all four patients died and two of them before their operation was completed. The remaining patient steadily refused operation and died on the third day after his injury.

In the case of the first patient, upon whom I operated, the abdominal cavity was not only found to contain a very large amount of blood, but as soon as the peritoneum was opened blood welled up in large quantities from an extensive laceration of the right lobe of the liver, and before anything could be done to arrest it the patient had died, not from the blood lost prior to the operation but from the profuse and uncontrolled hemorrhage that took place from the torn surfaces of the liver after the peritoneum was opened and the tension inside the abdomen released. Later it occurred to me that if the portal vein had been compressed in the anterior boundary of the foramen of Winslow the hemorrhage might have been so far temporarily arrested as to permit a thorough treatment of the torn vessels.

My second operation case came shortly after the first and after opening the abdomen an assistant held the portal vein and the hepatic artery between a finger and thumb and

completely arrested all bleeding, and we got on a little further in consequence of being able to wipe out blood and blood clot and to examine the rupture; several silk ligatures were passed and drawn up and some packing applied round the seat of the wound, but the patient died in spite of it, very soon after the operation was completed.

I had, in the interval between the occurrence of these two cases convinced myself, after observations carried out in the post-mortem room, that a completely satisfactory and tolerably easy method of arresting hemorrhage was probably to be obtained by passing ligatures through the liver substance at a sufficient distance from the margins of the wound to make certain they would not slip, and by pulling these up as tight as possible, allowing them to cut completely into the liver tissue; the coats of the vessels in the liver are sufficiently resistant to permit this to be done without giving way themselves. After this, if one obstructs the inferior vena cava and then forces fluid through the portal vein, it will be found that practically no escape will take place from a cut surface in the liver, even though the pressure of the fluid be very much greater than that of the portal blood stream in life—if any does come away, it is the merest ooze, and in actual practice any oozing of blood of this nature and degree could always, I believe, be controlled by packing.

This is the method originally described by Kusnetzoff and Pensky which I only learned after reading the very admirable paper of Anschutz, on Resection of the Liver. Kusnetzoff devised some special needles for passing the sutures—blunt-pointed and short, with varying curves. I used a handled needle of soft steel which could be variously curved as required and an improved model was made for me by Messrs. Baird Bros., Glasgow, which has proved quite efficient in these cases.

As far as my experience goes it is quite as easy to work with this suture as it is to employ the method of compressing the margins of the liver wound with such things as strips of whalebone as suggested by Cecherelli and Bianchi—or with

the articulated support of Segale—or the strips of magnesium metal more recently suggested by Payr and Martina; for each of these contrivances requires the use of sutures in the liver to hold it in position, and while magnesium may, as is claimed for it, be absorbed, it is quite probable that the whalebone or ivory strips, even though decalcified, might ultimately have to be removed. I do not believe these forms of apparatus will have any permanent place in the surgery of the liver but that they will disappear just as the bobbins, etc., have disappeared or are disappearing in the surgery of the gastro-intestinal canal.

When I began to look into the subject of the treatment of injuries to the liver and the arrest of hepatic hemorrhage it came as rather a surprise to find it stated in Langenbuch's volume, in the "Deutsche Chirurgie," on the Surgery of the Liver, that Ponfick and others had had such disastrous results from obstructing the hepatic and portal vessels in their experimental animals. I have not seen the original papers, but Langenbuch states that death of the animal occurred almost "at once from collapse" in some instances or "within a few hours" in others apparently owing to stagnation of blood in the portal area. I have some difficulty in understanding why an animal should necessarily die under such circumstances as rapidly as is stated to have been the case in these experiments, though, if the interference with the portal vein had been so long continued as to affect the vitality of the coats of the bowel it would lead to gangrene and peritonitis, but in that case death would not be immediate. At any rate, the method had afforded me such decided advantages at the time in the only case in which I had till then employed it, although the patient did not survive, and he certainly did not die because his portal vein had been obstructed, that it seemed it might be worth while to endeavor to determine the effect by experiment again. This I was enabled to do several years ago in the Pathological Institute in Vienna and I desire now to express my thanks to the Director, Hofrath Professor Weichselbaum, for the privileges so kindly afforded me there.

In my experiments I employed rabbits as Ponfick had previously done. The animals were anæsthetized with chloroform, the abdomen opened and the portal vessels clamped with a narrow pressure forceps, the blades of which were covered with rubber tubing. The first animal, a large buck rabbit, was kept in full anæsthesia for one hour after the clamp was applied to the vessels and during this time the surface of one of the lobes of the liver was freely cut into at several places but no bleeding followed; at the end of one hour this lobe was cut off and *then* the ligatures were passed through the stump and tied and after that the clamp was removed, but no blood escaped from the cut surface during the time that elapsed between the amputation of the lobe and the passing and tying of the ligatures; hemorrhage had been controlled as perfectly as could be desired. As far as the intestines were concerned the only change that had occurred by the end of the hour was that in color they were possibly a little darker than they had been when the abdomen was first opened, but even this was comparatively slight.

Three other animals were treated in the same way, but the clamp was only kept on the portal vessels long enough to permit the amputation of one of the liver lobes which was always done *before* passing the ligatures through the stump. Hemorrhage was completely controlled in all of them and no obvious change occurred in the appearance of the intestines. Moreover, all four animals recovered from the operation, fed well and developed no abnormal symptom, and, as the time at my disposal was short, were killed on the third or fourth day after the operations, but beyond recent adhesions round the cut and ligatured stump of the liver nothing abnormal was found on post-mortem examination in any one of them. It was not considered necessary, therefore, to continue the experiments over a greater number of animals, for their object seemed to have been attained. The animals survived the temporary obstruction of their portal circulation and did not appear to have been in any way injured by it.

Since these experiments were made two patients with rup-

ture of the liver have been operated upon by me, and in each case the hepatic and portal vessels were grasped between fingers and thumb as soon as the abdomen was opened, while blood clot, etc., was cleared out of the abdominal cavity and the necessary manipulations were being carried out on the liver. In both cases the method acted admirably, perfect control of the bleeding areas of the liver was obtained and a clear field for operating. Of these two patients the first to be operated upon died before the operation was completed. To the second of them I shall refer immediately.

A suggestion was made by Ponfick and it is spoken of with favor by Langenbuch, regarding the possibility of avoiding the dangerous congestion of the intestines which followed on obstruction to the portal circulation, and it is this, that the superior and inferior mesenteric arteries should be tied (temporarily) in the first place and then the portal vein obstructed; but it appears to me as the result of my experience with the experimental animals as well as in the case of three patients that this is not necessary. The time that would be required to tie the mesenteric arteries must be taken into account, for in the case of such patients with a degree of shock present that is always great and often extreme and moreover who are suffering from great loss of blood, time in the operation is a consideration of the first importance.

The proposal of these writers with regard to the freeing of the liver from its attachments to the diaphragm and posterior abdominal wall is, however, one of great value and would appear to offer considerable possibilities to a surgeon. For in these cases, after the further occurrence of hemorrhage has been prevented by holding the main vessels, and the field of operation has been cleared of blood, the difficulty of obtaining access to a wound situated far back upon the upper or lower surface and particularly the upper surface of the large right lobe of the liver is very great, and it will occasionally prove to be impossible unless more open access can be obtained. This, however, can be obtained in one of two ways, either (1) by dividing the coronary and right lateral ligaments

of the liver and thereby freeing it so as to allow the liver to be dislocated and delivered up to the abdominal wound as was originally suggested by Langenbuch; or, as I think (2), by freeing a portion of the lower thoracic wall by dividing the ribs and holding up this flap of ribs and diaphragm. I do not know whether either method has ever been employed in actual practice; the latter is possibly the more severe of the two, but it might be quicker to carry it out and it might, in consequence, save time.

The difficulty in such a case is to some extent illustrated by that of the last patient upon whom I operated. This man had symptoms pointing to rupture both of the liver and of the right kidney. I opened the abdomen first and could easily feel the liver wound situated on the right lobe, just in front of the upper layer of the coronary ligament; as far as the introduction of ligatures was concerned it was entirely inaccessible and I considered the question of making a thoracic flap or of dividing the ligaments to get access to it, but decided for the latter as it was necessary to explore the kidney from the loin and the possibility of urine escaping from the wound had to be kept in mind. In trying to carry out this division of the ligaments it proved an extremely difficult matter to get at them; in spite of the large perirenal hæmatoma which tended to project the liver forwards, for with the longest (8 inches) scissors available I could only reach and divide the lateral ligament. The convexity of the upper surface of the liver itself appeared to the chief obstacle to getting at the coronary ligament, but having got the lateral ligament divided it was found possible, by traction and pressure, etc., to tear the upper layer of the coronary ligament; although this succeeded to some extent it quickly became apparent that the rupture in the the liver tissue was being considerably enlarged by the manœuvre and it became necesszary in consequence of this to desist from further attempts in this direction. I had to finish by packing the suprahepatic space which, as it turned out, acted very well, for very little hemorrhage took place after this: the right kidney, was then exposed from behind and a large extravasation of blood there evacuated and the perinephritic space was packed also, for although the kidney was extensively ruptured it was thought the patient's chance of life would be diminished by

a nephrectomy at that time. He carried on well for two days and then developed signs of consolidation of the right lung and died on the fourth day after his accident and operation. At the post-mortem examination it was found that practically no further bleeding had occurred from the extensive rupture of the liver and none from the kidney and there was no peritonitis, but the right lung was in an early stage of gangrene, due, doubtless to embolism. It has been shown in the experimental work that embolism of the pulmonary vessels consequent upon thrombosis of the liver vessels is as common as it is fatal.

A question of some importance, in these cases, arises as to the time when operation should be carried out. One of my patients lived for three days after his injury, and although it was believed he had a rupture of the liver and operation was repeatedly urged upon him, he persistently refused to submit to it. He died with symptoms pointing to intestinal obstruction, viz., constipation and fecal vomiting, and at the post-mortem examination it was found that the abdominal cavity contained a very large amount of blood and there was a rupture of the liver far back against the coronary ligament which would certainly have been difficult of access for the purpose of applying ligatures to the torn liver vessels. But the liver wound was full of ante-mortem clot; the tendency to hemorrhage had been spontaneously arrested, and if the abdominal cavity had been emptied of blood and the region of the liver injury merely packed, the patient might have got through.

The mere act of opening the abdomen, in some, at any rate, of these cases is, I feel certain, associated with an increase of the amount of blood that is lost to the patient. The blood pressure in the portal vein is not great and as the result of the local injury and the extravasation of blood there is produced reflexly a state of firm contraction of the abdominal muscles. The abdominal wall in these cases becomes absolutely rigid and board-like, the tension in the abdominal cavity thereby brought about must prevent at least a *rapid* escape of blood and may lead to its arrest altogether. No patient could survive the sort of hemorrhage that occurred on

opening the abdomen of my first patient from the liver itself—not the mere escape of the blood already extravasated into the peritoneal cavity—for more than a few minutes, in fact, this patient died immediately as the result of this hemorrhage. It would have been impossible to have got such a patient transported to hospital alive, had it not been that the hemorrhage had been delayed in the manner suggested.

It is very probable that slight ruptures will occasionally heal without surgical interference in consequence of this increased tension of the abdominal wall leading to the arrest of hemorrhage, but in the cases of severe injury to the liver this will not happen; many patients if left without surgical aid, will die from hemorrhage or shock in the first place, or if they get over these dangers will succumb later from intestinal obstruction and peritonitis, when the extravasated blood becomes infected from the bowel, of which it has every chance, if such a patient hold on long enough. So that if these severe cases are to be got through at all, I feel that operation must be an immediate one for the majority, and that some of these patients can be saved is well seen from Terrier and Auvray's figures.

It is a most unhappy calamity that a patient, whose life one is endeavoring to save, should die before an operation is completed, but it is a risk that has occasionally to be faced and in these cases of injury to the liver, one is most likely to avoid it, I believe, by rapidity of operating, and this will be favored by the immediate arrest of the active hemorrhage that is going on, by seizing the portal vessels as soon as the abdominal cavity is opened; for by so doing one can obtain a clear field and therefore time is gained for the treatment of the wound of the liver itself.

The permanent arrest of hepatic hemorrhage is, in my opinion, best effected by ligation of the liver tissue in mass in every case where that is possible, but in some cases it may not be practicable and then we will have to rely solely upon packing.

CAUSE OF SUDDEN FALL IN BLOOD-PRESSURE WHILE EXPLORING THE COMMON BILE-DUCT.*

BY J. LOUIS RANSOHOFF, M.D.,

OF CINCINNATI, OHIO,

THE essential feature or symptom of shock is a fall in blood-pressure, which may be due to one or many causes. Recent experiments, particularly by Crile, have shown that in most cases shock is due to vasomotor paralysis from excessive nervous stimulation. Shock in abdominal operations is more marked in the upper regions of the abdomen, increasing as the diaphragm is approached. Mayo has noticed the great liability to shock in operations and manipulations of the common duct. All operators of any experience agree that during these operations the pulse may suddenly become rapid and small, and the respiration shallow and frequent. These symptoms have been attributed to a temporary vasomotor paralysis due to excessive insult to the great splanchnic plexus of sympathetic nerves.

We began this series of experiments with the preformed idea that these symptoms were dependent on the overstimulation and insults to the sympathetic nerves, but we soon learned that our premises were wrong. Rabbits of a uniform size were the subjects of these experiments. They were in all cases anæsthetized with ether before beginning the operation. Under complete anæsthesia the trachea was exposed and the breathing cannula inserted. This was connected with a bottle and the anæsthetic continued in this way. The carotid was then exposed and a glass cannula introduced connected with a Hürthle manometer. The records were taken on smoked paper on a revolving drum of the Porter model.

* From the Physiological Laboratory of the Medical College of Ohio, University of Cincinnati.

Respirations were not recorded as the apparatus markedly interfered with carrying on the experiment. Twenty-five experiments were made in all.

In the earlier experiments, various manipulations were made in the region of the pylorus, the duodenum and the common duct. These manipulations had no effect on the blood-pressure, with the exception of a slight and gradual fall. The manipulations were made as follows:

1. Opening of the abdomen, resulted in a very slight fall with a quick return to the normal pressure.

2. Traction on the gall-bladder, no effect.

3. Traction on the pylorus and thus on the gastrohepatic.

   a. Traction in a pedad direction, no effect.

   b. Traction in a ventrad direction, slight fall.

Although difficult to prove, it seems from subsequent experiments, that the fall in blood-pressure in ventrad traction of the gastrohepatic omentum is due to a slight kink of the portal vein and interference with the return flow.

4. Vigorous sponging in this region resulted in a slight and gradual fall.

In the second series of experiments, the pylorus was isolated and the tip of the small finger was introduced into the foramen of Winslow. Care was taken that no pressure was made on the vena cava. In each case at the instant of introduction of the finger into the foramen of Winslow, a sudden and marked fall of blood-pressure with rapid and small pulse was noticed. The fall ranged from twenty to forty millimetres of mercury. The blood-pressure continued at this low ebb as long as the finger was held in the foramen. As soon as the finger was removed, the blood-pressure arose to its previous level. The results in these experiments were absolutely constant. For example experiment No. 12:

Full-grown rabbit in good condition; ether anæsthesia, tracheal breathing cannula and cannula in carotid. Initial blood-pressure 80 mm. of mercury. Abdomen opened in epigastric region, pressure 75 mm. The tip of the little finger was now introduced into the foramen of Winslow and held there ten seconds. Blood pressure, 40 mm. The finger was now removed and the blood mounted to 80 mm. After allowing the blood-

pressure to regain its normal level, the finger was again introduced into the foramen and held in place for twelve seconds, with a resulting fall to 40 mm. After removing the finger the pressure rose rapidly to 80 mm. This manœuvre was repeated several times with like result; the animal then killed. The accompanying tracing (Fig. 1) showed the experiment in detail.

In another experiment, a hook was introduced into the foramen of Winslow and upward traction was made with the same result as in the preceding experiment. This was done to make sure that no pressure had been made upon the vena cava.

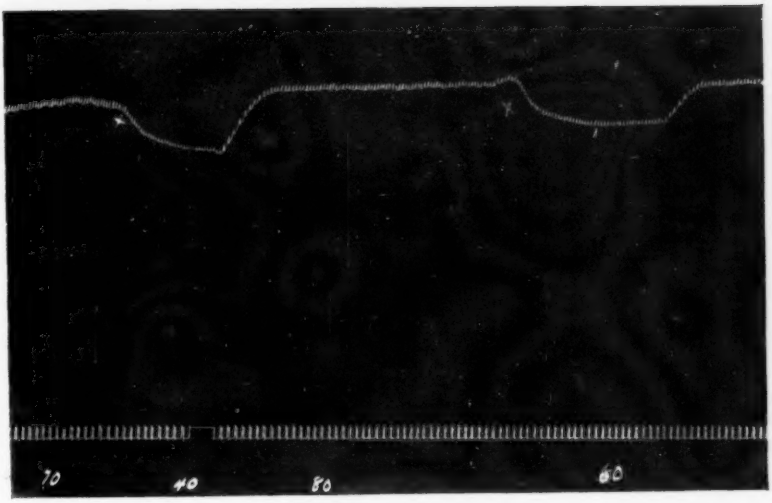
A series of control experiments was now made. The gastrohepatic omentum was now exposed and the portal vein was isolated as far as possible. The vein was now temporarily clipped and the same drop in blood-pressure was noted, except that the drop was more marked.

Experiment 15. Full-grown rabbit, ether anæsthesia, tracheal breathing cannula, cannula in carotid artery; pressure, 105 mm. The portal vein was now exposed, during which manipulation slight variation in blood-pressure was noted. A temporary clip was now applied and left in place for twenty-two seconds. The blood-pressure fell to 50 mm. The clip was now removed and the pressure gradually rose to 100 mm. The animal was then killed. The accompanying tracing (Fig. 2) is a graphic record of this experiment.

Control experiments were now made in the operating room on human subjects, and in each case the same result was obtained. The Recklinghausen tonometer was used. The following is typical of the results obtained:

Mrs. S., aged 40. Diagnosis: Stone in common duct. Operation at Jewish Hospital by Dr. Joseph Ransohoff, November 27, 1907. Gas-ether anæsthesia, initial blood-pressure 110 mm. Abdomen opened, pressure dropped to 105 mm. Gall-bladder freed from adhesions, no change in blood pressure. Finger introduced into foramen of Winslow in search of stone in common duct, and resulted in a prompt fall of the blood-pressure to 70 mm. Finger removed and blood-pressure rose to 105 mm. During the subsequent course of the operation, this manœuvre was repeated with like result (see Fig. 3). The stone was found in the common duct, and the operation concluded with hepatic drainage.

FIG. 1.



Tracing of experiment No. 12.

FIG. 2.

Tracing of experiment No. 13.

It will be seen from these observations that the marked fall in blood-pressure occurred when the common duct was explored by introducing the finger into the foramen of Winslow. In this manipulation the structures in the gastrohepatic omentum are lifted in the crook of the exploring finger and inadvertantly the portal vein is compressed. This partially closes its lumen, resulting in the shutting off of a great quantity of blood from the general circulation and the consequent lowering of blood-pressure. That the fall of blood-pressure occurs at the instant of the introduction of the finger into the foramen of Winslow, and in every case remains at the low level while the finger is held in place. The fall of blood-pressure is due entirely to pressure on the portal vein is conclusively shown by experiment 15, in which the portal vein was clamped and an immediate fall occurred.

Knowing as we do the results of this pressure on the portal vein, I think that the digital exploration of the common duct should be intermitted at short intervals to allow the circulation to regain its normal tone.

I am indebted to Dr. Edward Baehr, director of the laboratory, for his valuable suggestions and kind assistance.

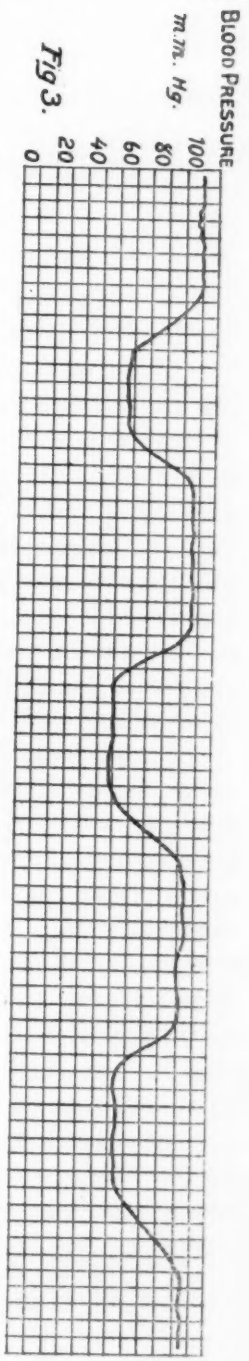


Fig 3.

Chart showing variations in blood-pressure.

A METHOD TO FACILITATE THE AVOIDANCE OF INFECTION DURING INTESTINAL ANASTOMOSIS—PRELIMINARY REPORT.*

BY J. HALPENNY, M.D.,

OF WINNIPEG, MANITOBA,

From the Physiological Laboratory, University of Manitoba.

In the early attempts at securing union of divided intestine the chief difficulty was probably found to be in suturing, so that the continuity of the bowel was preserved. In order to meet this difficulty there arose many mechanical devices, used largely in end-to-end union. Different stages of development of these mechanical aids may be traced until the climax was probably reached when J. B. Murphy perfected the button known by his name. Not content, however, with this improved method, the efforts of surgeons were exerted towards doing away with mechanical aids altogether, and the Connell stitch in end-to-end union has accomplished this very well.

During the years covered by this progressive development many surgeons were using lateral anastomosis because the stitching is more easily carried out without any mechanical aid than in end-to-end union. At the present time some surgeons prefer the end-to-end or end-to-side method in practically all cases. Others, however, prefer lateral anastomosis in many cases. Mayo [1] says, "Lateral anastomosis, with end-to-end closure by the two-row suture method, we believe to be the safe resection for *acute* obstruction of the small intestine. . . . After resection for chronic obstruction of the small intestine end-to-end union is the operation of choice. . . . The ileocolic anastomosis should be lateral. . . . In resecting part of the transverse colon, end-to-end or lateral anastomosis may be performed. The Murphy button should

* Read before the Scientific Club, Winnipeg, April 7, 1907.

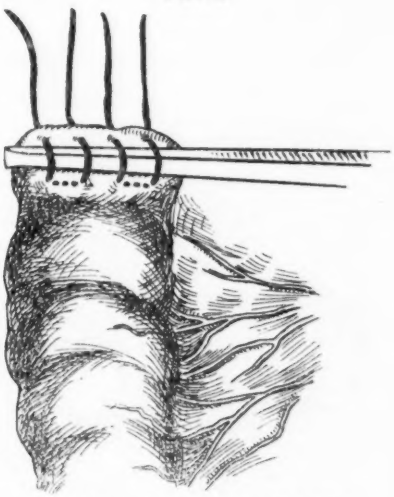
[1] Transactions Surgical Section American Medical Association, 1907.

be avoided, as there may be fecal masses of sufficient size to obstruct the lumen of the bowel."

This may be taken as a fair expression of the choice of methods; and it shows that lateral union is preferred by surgeons in many cases. Physiological workers such as Cannon, however, prefer end-to-end union because the immediate functional results are said to be better than after the lateral.

One of the difficulties in lateral anastomosis is that of avoiding infection of the field of operation at the time the

FIG. 1.



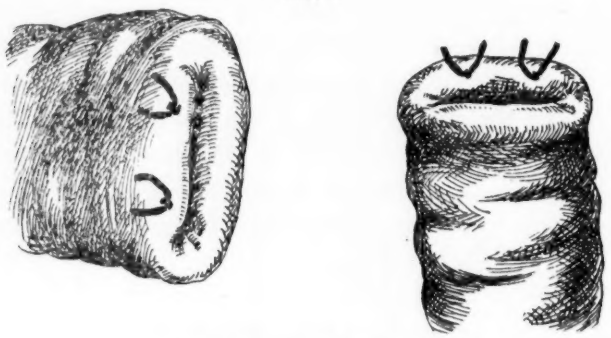
Inversion of cut ends of intestine.

artificial opening is made and before it is inclosed by suture. It was to overcome this difficulty that the operation here described was devised and tested.

The mesentery is treated in the usual way. The cut ends of the intestine are inverted by two Halsted stitches (Figs. 1 and 2). The intestine is lapped about four inches and a continuous silk suture fastens the two limbs together by going up just alongside the centre opposite to the mesentery, and back again just as far from the centre of the intestine as the former line of suture and on the opposite side (Fig. 3).

The knife (Fig. 4) is now inserted as shown (Fig. 5), entering the lumen of the bowel near one end of the intestine, and with the blade parallel to the circular fibres. It is passed

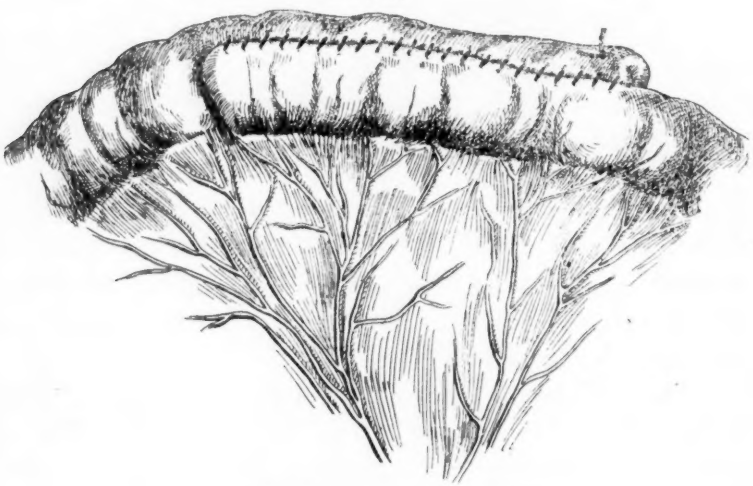
FIG. 2.



Cut end of intestine after inversion.

along the lumen of the bowel as far as the shank will allow (Fig. 6) and the artificial opening is made through the two

FIG. 3.



Lapping of the two sections of intestine.

layers of bowel by cutting back (Fig. 7). A purse-string suture is now placed about the knife, and, the knife being withdrawn, the hole is closed (Fig. 8).

The knife (Fig. 4) is made with a narrow, short blade and a long shank. The blade makes a very small hole, and the long shank allows the knife to pass up far enough in the intestine to make an opening sufficiently large. There is no danger of cutting the stitches, neither is there any danger of cutting too deeply. Sensation guides one in this.

FIG. 4.

One objection to this incision is that bleeding may occur, because the cut edges are not sewn over. I have found no difficulty arise from this in the few dogs I have operated on.

Up to the present my operation has been performed exclusively on dogs. So far I have operated on six and in only one of these has a fatal result supervened. This one was a very small puppy, the intestine, when flattened, measuring only one-half inch. Death was caused by gangrene of the bowel due to the stitches cutting off the circular vessels. The mesenteric circulation was not interfered with, neither was there any peritonitis. At the postmortem the artificial opening was larger than the lumen of the bowel.

The dogs were fed and watered as usual from the day of the operation. No blood was passed in the stool of any one of the six. Owing to the limited amount of space for housing animals the average length of time they were kept was only nineteen days, but with one exception besides the fatal case the animals seemed as well as ever. In that case there was not a large enough opening and the nutrition of the animal suffered somewhat before he was sacrificed. This case was operated on before I got the special knife made.

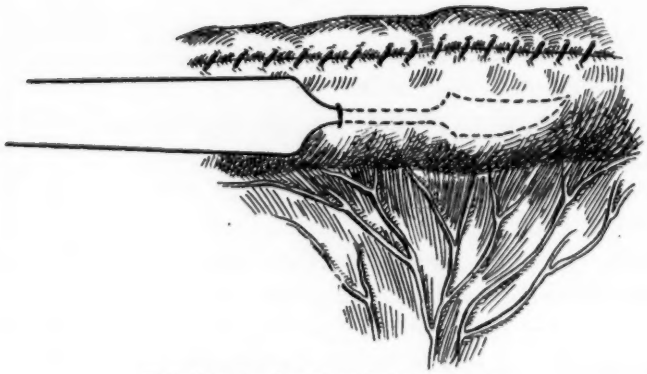
In no case was there any sign of peritoneal infection.

One dog had a stitch abscess in the abdominal wall, but in all the others the wound healed by first intention.

FIG. 5.

Inserting knife.

FIG. 6.



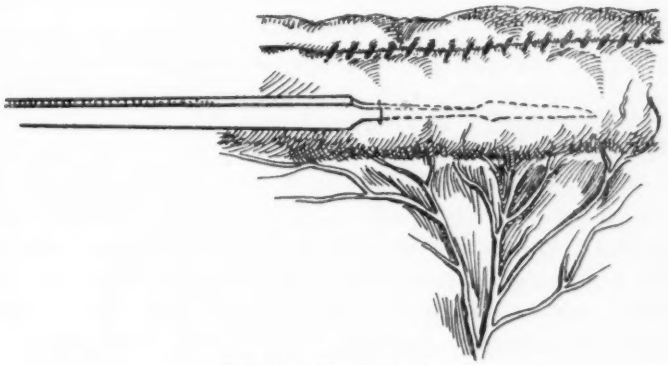
Knife introduced as far as shank will admit.

It is my intention to continue the series of operations, and to vary the procedure in regard both to the length of the

intestine removed and to the anatomical situation of the resection.

If the operation I have described can be carried out in dogs with results approximating to uniformity, I shall have no hesi-

FIG. 7.



Knife in position for cutting.

FIG. 8.

A. Knot after removal of knife.

tation in adopting the method in the case of the human intestine.

PRIMARY CARCINOMA OF THE APPENDIX.

REPORT OF TWO CASES.

BY A. E. GARROW, M.D., AND C. B. KEENAN, M.D.,

OF MONTREAL,

Assistant Surgeons, Royal Victoria Hospital.

CASE I.—Miss E. Y., aged 21, was admitted to the Royal Victoria Hospital on October 1, 1906, complaining of pain in the right lower quadrant of the abdomen. Seven years ago she had for a short period what she calls a " dead soreness " in this region, which was aggravated or brought on by over-exertion. She frequently complained of pain in this side when menstruating, otherwise her general health has been good. Four weeks ago, however, she had an unusually severe attack of pain, accompanied by vomiting, necessitating her confinement to bed at that time for a day or two, and since then she has had in all five similar attacks. In the intervals she was free from pain but there was an abiding tenderness on pressure in the right side. Examination on admission revealed some tenderness to pressure at or about McBurney's point, and a small tender mass could be palpated two finger-breadths below a line running from the umbilicus to the anterior superior iliac spine.

On October 4th incision revealed a slightly adherent appendix, constricted three quarters of an inch from the base and very much distended at its distal portion. There was little evidence of peritoneal inflammation old or recent. The patient made an uninterrupted recovery and from the last report has remained well.

Section of the appendix showed complete occlusion for about one inch, the distended and thinned out terminal part containing clear mucoid material. At the operation this was regarded as a typical example of obliterating appendicitis and I am indebted to Dr. Keenan for the opportunity for adding another case of primary carcinoma of the appendix to the rapidly increasing number of such cases now recorded.

Microscopical examination showed that the occluding mass was not an inflammatory nodule, but a cubical-celled carcinoma

infiltrating all the coats of the appendix. But for the routine examination of all morbid material in the surgical clinic this case would have passed unrecognized. I am indebted to Dr. Mackey of Grenville, who sent the patient to the Hospital, for the opportunity of securing the specimen.

CASE II.—The second patient, I. F., a girl aged 13, was admitted to the Royal Victoria Hospital on March 19, 1907, complaining of pain and tenderness in the right iliac region. Dr. Harwood of Malone who had charge of the patient previously, stated that on March 13th she had been suddenly seized with severe pain in the right iliac region with nausea and vomiting. Extreme tenderness soon developed in the appendix region associated with an increased pulse-rate and moderate fever.

When admitted the patient's condition strongly suggested a perforated appendix with localized peritonitis and she was operated on immediately. The appendix was found lying over the brim of the pelvis, which latter was filled with pus. On freeing the appendix from very slight adhesions its distal third was found dark, almost gangrenous, and distended, measuring one inch in diameter and showing a small perforation. The proximal two-thirds exhibited slight congestion of the serosa only.

Examination of the removed appendix showed a small new growth blocking the lumen just proximal to the swollen portion and this latter consisted of a distended gangrenous appendix well filled with pus. Sections of this growth showed it to be a small cubical-celled carcinoma markedly resembling a rodent ulcer. The greater portion of the mass projected into the lumen, but it also invaded the muscular coats and a few groups of the tumor cells lay just beneath the serosa. The small cubical cells of the tumor were quite distinct in type from the tall columnar cells lining the remaining lumen of the appendix and transition forms could not be found.

The patient made an uneventful recovery and at the present time, a year later, is in perfect health.

Until quite recently carcinoma of the appendix, unless secondary to cæcal cancer, has not been recognized or recorded except in a very few instances. In late years systematic examination of all appendices removed has revealed the fact that primary carcinoma of the appendix is not a rare condi-

tion, for the above two, with those previously recorded make eighty-four cases of primary carcinoma of this organ.

It is interesting to note that most if not all of these cases were diagnosed only when the nodule was sectioned. This is true of our two cases and they both illustrate well one type of the so-called " primary carcinoma " of the appendix, occurring as it so frequently does in young people, Brandts [1] having reported such a case in a seven-year-old boy and Zaaijer [2] another in a girl of twelve. Vassmer,[3] in a recent communication, has stated that such growths do not give rise to any symptoms until appendicitis develops, and believes that the nodule is indirectly responsible for the onset of the inflammatory symptoms. Cases are recorded, however, where such growths were discovered quite accidentally on the post-mortem table, or where laparotomy had been performed for some other condition.

A careful histological study of our two specimens shows that the new growths originated in the submucosa, possibly from embryonic rests, for the small cubical cells composing the growths are quite distinct and apart from the tall columnar cells lining the remaining lumen of the organ.

Some pathologists have termed these nodules " endotheliomata." We must regard such growths as carcinoma in spite of their small size, slow growth, not recurring when the appendix is removed, nor giving rise to metastases, while, as already pointed out, they infiltrate contiguous tissues.

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[1] Brandts. Munch. med. Woch., 1907, s. 1780.
[2] Zaaijer. v. Brunnsche Beitrage z. klin. Chir., Bd. 54, H. 2, s. 239.
[3] Vassmer. Deutsche Zeit. f. Chir., Bd. 91, s. 445, 1908.

CARCINOMA OF THE APPENDIX VERMIFORMIS.

BY GEORGE H. MONKS, M.D.,

OF BOSTON, MASS.,

Surgeon to the Boston City Hospital.

CASE I.—*Appendectomy for chronic appendicitis; a carcinoma found by the pathologist within the chronically inflamed appendix; rapid convalescence of the patient; the patient in perfect health about 5½ years after operation.*

X. Y., a housemaid, a strong and well-built woman, 24 years old, who had previously been troubled more or less with indigestion for an indefinite period, entered the Boston City Hospital in September, 1902, with symptoms of chronic appendicitis, from which she had suffered for two days. This illness began with pain which was more or less general over the abdomen. Later the pain became limited to the lower half of the abdomen, somewhat more marked, however, on the right side than on the left. There had been no vomiting, and with enemata the bowels had moved freely.

The general condition of the patient, at the time of entrance, suggested little in the way of constitutional disturbance, and her face was not expressive of severe pain. Temperature, 100.5; pulse, 100; no spasm of abdominal muscles; moderate tenderness in lower abdomen, especially on the right side. The diagnosis of chronic appendicitis was made, and at operation—some days later—the appendix was removed. It presented the appearances of chronic inflammation. It was not opened, however, but was sent at once to the pathologist.

Dr. F. B. Mallory kindly furnished the following report on the specimen, and also the photographs (see Figs. 1, 2 and 3).

"The gross specimen consists of an appendix 5 cm. long. The serous surface is congested. The mucous membrane is grayish and gelatinous. Occluding the lumen 1.5 cm. from the distal end is a yellowish nodule 0.6 cm. in diameter.

"Microscopically the nodule consists of irregular masses of epithelial cells arranged in an alveolar manner in a moderately abundant connective-tissue stroma. The epithelial cells occur partly in solid clumps, partly

lining gland-like cavities. Some of the larger clumps of cells show several small lumina present. The epithelial cells vary in shape from spherical to cuboidal and cylindrical.

"The growth is limited to the mucosa and submucosa, of which remains are still evident in places. The muscle coats are not invaded. On the other hand, they show considerable infiltration in places with lymphocytes and a few of the lymphatics in the serous coat are filled with similar cells. These cells indicate a chronic inflammatory process, but whether due to the tumor or to a separate process it is impossible to state positively. The infiltration is identical in appearance, however, with the condition found in many appendices removed between attacks of inflammation.

"*Anatomical diagnosis,* carcinoma of appendix, chronic appendicitis."

The patient made an uneventful recovery from the operation, and was discharged from the hospital twenty-four days after it.

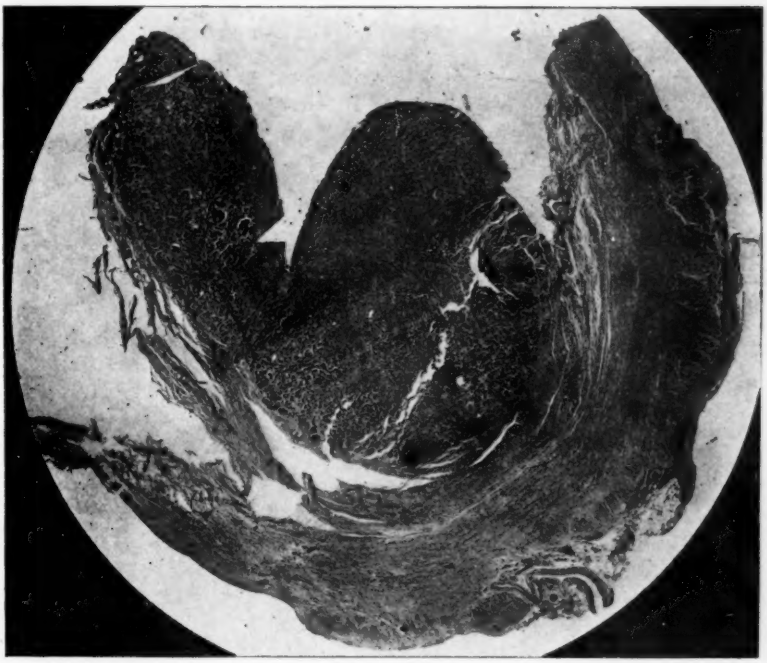
Since this I have heard from her from time to time, and, finally, last February, in answer to a note of inquiry, I received a letter in which she used the words "I am in the very best of health at present and have been since the time of my operation."

A month later, at my request, the patient presented herself for examination. I made a careful examination of the abdomen, especially of the right lower quadrant, but failed to find any indication whatever of recurrence. The patient was apparently enjoying excellent health. This was nearly 5½ years after operation.

This case is reported (1) because, in view of there being no evidence of recurrence 5½ years after removal of the carcinoma, the growth was probably primary in the appendix; (2) because the appendix was removed on account of appendicitis, there being no suspicion as to malignant disease until the report on the specimen was returned by the pathologist.

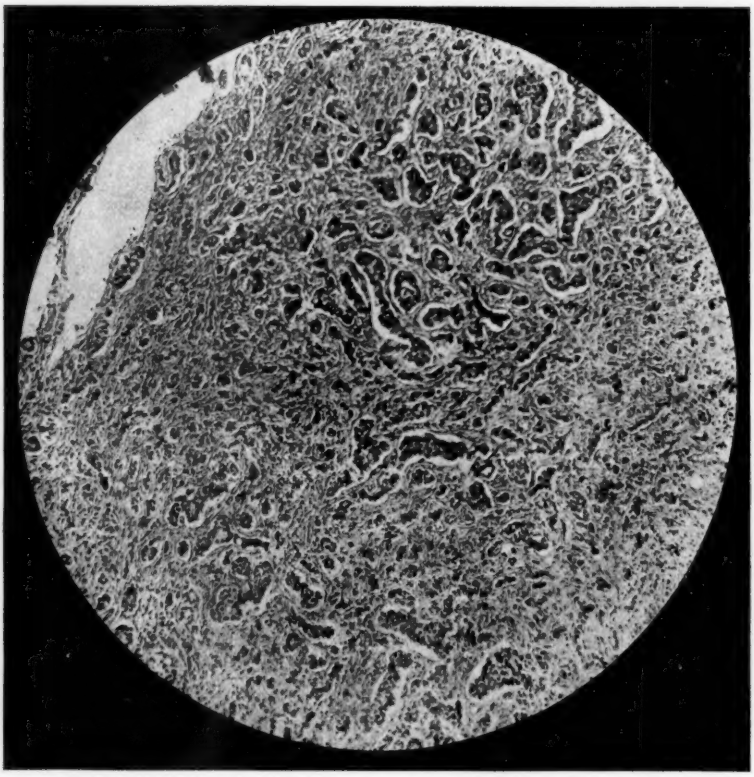
Apparently the attack of appendicitis was an important factor in saving the patient's life.

FIG. 1.



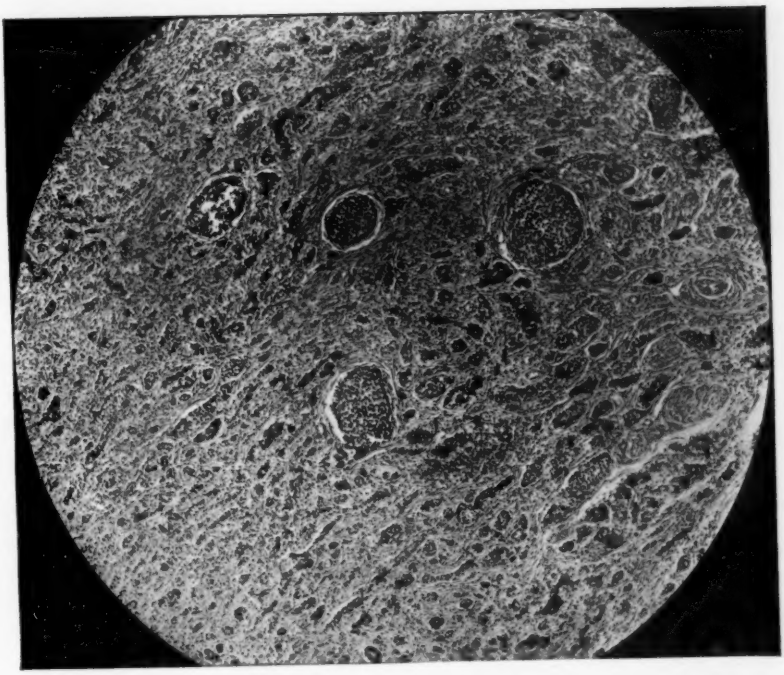
Cross section of appendix which has been slit open longitudinally: shows tumor involving mucosa and submucosa.

FIG. 2.



A portion of section displayed in Fig. 1, under moderately high power to show the alveolar arrangement of the tumor.

FIG. 3.



Same as in Fig. 2, but under higher power.

CHYLE CYSTS OF THE MESENTERY.*

BY WILLIAM BARRETT BRINSMADE, M.D.,

OF BROOKLYN, NEW YORK.

Surgeon to the Long Island College and St. John's Hospitals.

THE first accurate description of this disease is found in the report of an autopsy by Rokitansky in 1842. Hahn in 1887 made the first classification of mesenteric cysts, which included those containing chyle as a distinct class.

The mesentery of the small intestine consists of two layers of peritoneum, which separate as they approach the intestine to enclose it and form its peritoneal coat. Between the layers of the mesentery we find fat, lymph vessels with blood vessels accompanying them, and mesenteric glands, varying in number from 150 to 200. The lymphatic vessels which are here called lacteals, on account of the color of the fluid they carry, form by two plexuses in the villi of the small intestine. One plexus lies between the muscular coats, and one beneath the mucous membrane. They anastomose freely and are accompanied by a very complete set of blood vessels, as is beautifully shown in the dissections of Mr. Evans.[39]

The lacteals leave the intestines and extend about 1½ inches to the first series of glands; there they become fewer in number and larger in calibre, and extend to a second series of larger glands situated on the primary arches of the arteries. From these again the efferent vessels of the third set of glands unite to form two or three trunks, or one trunk of large size, the truncus lymphaticus intestinalis. This joins with the right and left truncus lymphaticus lumbalis to form the receptaculum chyli of Pecquet.

These cysts may appear either as dilated lacteals, as collections of chyle between the layers of the mesentery, or as enlargements of the cysterna chyli.

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* Read before the New York Surgical Society, May 13, 1908.

Most observers find the cause of the trouble in a degenerated lymph gland. The theory being that as the gland becomes obstructed, obliteration of the efferent vessels at the site of the gland takes place, and there being an unhindered flow in the afferent vessels, there must be an accumulation of chyle. Werth [3] and Martin have each found a portion of hypertrophic mesenteric gland on pieces of the cyst wall removed for examination. Martin found a gland in condition of cystic degeneration and was thus able to confirm this theory.

Neither endothelium nor epithelium have ever been found on the inside of the cysts.

It will be seen that the size of these cysts will depend on the location of the lesion along the lacteal tract, and on the limit of expansion of the containing walls.

Several lymphatic glands may degenerate about the same time and form a number of cysts, as is illustrated in the annexed table. The cyst may become displaced by its own weight, so as to form a pedicle, or, it may occupy such a position as to partly occlude the bowel by pressure.

Two cases of this disease have come under my observation:

Case I.—The first patient was a male 32 years old. He had had several attacks of abdominal pain which were referred to the appendix. He had suffered from indigestion and had been careful of his diet for some time. At the time of operation he had been suffering with symptoms of appendicitis for one week. His abdomen was greatly distended. A mass could be felt in the region of the appendix. Strangely enough he did not feel very badly and had walked to Dr. Parrish's office where I saw him. He was sent to the Long Island College Hospital and a gangrenous appendix removed with a quantity of foul pus. The peritoneal coat of the colon was also found gangrenous. After this operation the patient improved somewhat in general condition, but his abdominal distention remained. A fecal fistula formed the third day after operation; but even this did not relieve his distention. His pulse ranged between 120 and 130, and his temperature between 101° and 103.° He vomited occasionally and had distress after taking milk. There had been several un-

satisfactory fecal movements with the expulsion of some gas. Expecting to find a pocket of pus, I explored the wound with my finger and felt a tense mass in the direction of the umbilicus, this ruptured easily and unexpectedly, filling the entire wound with a fluid that looked like thin milk and contained many flakes. I had evidently ruptured a chyle cyst. About 4 ounces of this fluid was sponged out and a drain inserted.

A few hours later the distention of the abdomen was much relieved, and there had been free evacuations, both by the natural passage and through the fistula. For several days there was a local point of tenderness over the region of the ruptured cyst and pressure there would produce chyle in the wound. This tenderness passed away in four days but the flow of chyle, in diminishing quantities, persisted for seven days. In this case we had in all probability a lymph gland degenerated as a result of the peritonitis, with an extravasation from one of the lacteal radicals forming a chyle cyst. This cyst pressed on the intestines which were already glued together by peritonitis and added to the partial obstruction. At any rate the rupture of the cyst almost immediately relieved the symptoms of obstruction. The patient gradually made a complete recovery. Of course the cyst may have existed for some time without giving symptoms. I find no case reported in the literature of a chyle cyst complicating appendicitis.

Case II.—An Italian eighteen years old was seized with acute abdominal pain March 24, 1907; he suffered from nausea and vomiting, but as it was on a Sunday night after indulging in overeating, not much attention was paid to him. He recovered and went back to his work after three days. Two days later he had a return of the same symptoms in a more aggravated form. I saw him, through the kindness of Dr. De Yoanna, on the seventh day of his sickness. We then obtained a history of indefinite abdominal distress extending over some months. The patient associated a blow received on the abdomen, with this distress.

When we saw him he was having paroxysms of pain with some nausea. His bowels had been moved only after several enemas, and then in an unsatisfactory manner.

A tumor of the size of a fœtal head could be easily made out, lying between the umbilicus and the pubis. It was freely movable in all directions, but traction downward caused pain.

CHYLE CYSTS OF MESENTERY.

Number	Reporter	Sex	Age	Location	Operation	Origin	Size	Recovered	Died	Remarks
1	Weichselbaum	M.	80	.....	Incision, drainage	Between layers of mesentery	½ inch diam	1		
2	Winiwarter	F.	4 mo.	Near vertebral column	Incision, drainage	.....	3 liters	1	....	Probably congenital. Noticed large abdomen since birth. Punctured four times.
3	Werth	F.	39	Umbilical region, median line	Extirpation	Mesenteric gland	Child's head	1	....	Noticed tumor for 3 months. Pain after eating.
4	Kuester	F.	21	.....	Extirpation	Between layers of mesentery	Adult's head	....	1	Septic peritonitis from wounding the bowel.
5	Killian	F.	61	Umbilical region	Incision, drainage	Distended ductus thoracicus	Large tumor	1	....	Noticed tumor for four weeks. Tapped twice 4700 c.c. of chyle withdrawn.
6	W	M.	31	.....	Extirpation	Mesenteric gland	Adult's kidney	1	....	½ liter fluid withdrawn. Had severe pain.
7	Fenominoff	F.	26	.....	Extirpation	Mesenteric gland	2 fists	1	....	2 tea-cups of fluid. No pain.
8	Söhlein	F.	57	Umbilical region	Incision, drainage	Mesenteric gland	4 fingers broad	1	....	Diarrhœa and pain for 8 weeks.
9	Rasch	F.	21	Median line mostly to left and toward pubis	Incision, drainage	Between layers mesentery	6 pts.	1	....	Cause stated to be rupture of chyle vessel.
10	Bramann	M.	63	Umbilical region. Freely movable	Incision, drainage	Cysterna chyle	Child's head	1	....	7–800 grm. fluid. Pain after eating.
11	Carson	M.	42	Umbilical region	Incision, drainage	.....	Adult's head	1	....	Wall very thick and hard.
12	Fetherston	F.	33	Pubis to 1 inch above umbilicus. Movable	Incision, drainage	Mesenteric gland	Adult's head	1	....	Noticed tumor for 18 mos. Pain severe for 3 mos. 3 pts. fluid.

13	Gusserow.....	F.	25	Umbilical region Movable	Incision, drainage	Between layers of mesentery	Adult's head	1	....	Pain in abdomen and back for 6 mos. 2½ liter fluid.
14	Tuffier.....	M.	48	Umbilical Region to right. Freely movable	Enucleation	Between layers mesentery. Mesenteric gland	Fœtal head	1	....	Tumor had a pedicle. Contained 600 c.c. of chyle.
15	Tuffier.....	F.	12	Below umbilicus	Incision, drainage	Mesenteric gland	.....	1	....	Constipation for many years. Abdomen distended. Chr. intes. obstruction. Multiple cysts; 2 large contained chyle. Many small cysts contained chyle.
16	Quinson.....	F.	20	Vertebral column	Incision, drainage	.....	.....	1	....	2 pts. chyle.
17	Wenning.....	F.	56	Entire abdomen implicated	.....	Between layers of mesentery	.....	....	1	Entire mesentery was filled with bodies that looked like hard boiled eggs without shells. Had noticed tumor 6 or 8 months. Died of shock.
18	Hover.....	F.	23	Umbilical region to right. Freely movable	Removed	Mesentery	7 in. long 3 in. wide	1	....	Tumor pedunculated. Noticed small mass 8 mos. before operation.
19	Reynier.....	F.	31	.....	Artificial anus	Mesentery	Fœtal head	....	1	Cyst pedunculated. Many attacks of peritonitis. Death due to peritonitis.
20	Pagenstecker.....	F.	10	.....	Extirpation	Mesentery	Apple	1	....	Tumor noticed 14 days.
21	Syms.....	M.	19	Umbilical region and above	Sack removed	Mesentery	14 oz.	1	....	Chyle.
22	Moynihan.....	F.	18	Umbilical region and to right	Extirpation	.....	.....	1	....	Sick 8 days off and on. Pain tenderness, vomiting and constipation.
23	Moynihan.....	M.	7	Right side umbilical region	Extirpation	.....	2 pts.	....	1	Sick 4 days abdominal pain and complete obstruction. Tumor had pedicle twisting around gut. Died of shock.
24	Eve.....	M.	11 wks	.....	Incision, drainage	Mesentery	Tangerine orange	....	1	Had wasted since birth, Diarrhœa and vomiting. Died 6 weeks after in convulsion.

CHYLE CYSTS OF MESENTERY (*Continued*).

Number	Reporter	Sex	Age	Location	Operation	Origin	Size	Recovered	Died	Remarks
25	Eve.....	M.	3½	Right lumbar region	Excision of sack. Tumor compressed intestine	Mesentery	32 oz.	....	1	Ac. intestinal obstruction for 4 days. Died of shock.
26	O'Conor.....	M.	41	Between umbilicus and pubis	Part of wall removed. Sac drained	Between layers	Cocoanut	1	....	Many dilated vessels.
27	Bennecke.....	M.	5	.....	Extirpation	Mesentery	1 child's head. 1 fist	....	1	2 cysts.
28	Dalziel.....	....	3	.....	Extirpation	Mesentery	20 oz.	1	....	Tumor had twisted the intestine.
29	Spaeth.....	F.	39	Med. line umbilicus and pubis	Incision, drainage	Mesentery	2 fists	1	....	Severe pain in abdomen for several months.
30	Beach.....	M.	55	Right side to pubis. Freely movable	Puncture. Incision and drainage	Between mesenteric layers	8 oz.	1	....	Tumor noticed 1 or 2 months. Pain after eating.
31	Anifrejew.....	....	26	.....	Incision and drainage	Mesentery	400 c.c.	1		
32	Ritter.....	M.	2¼	.....	Extirpation	Between mesenteric folds	Child's head	....	1	Abdomen increased in size for 1 year. Child has been weak and rickety.
33	Smoler.....	M.	60	Above umbilicus	Incision, drainage	Mesenteric gland	Child's head	1	....	Tumor noticed for 3 months. Pain after eating.
34	Fawcett.....	F.	3 mo.	Partly in cavity of pelvis	None	Mesentery	2⅝ x 1¾ inch	....	1	Child too ill to be operated.
35	Pannas.....	M.	45	Near umbilicus. Freely movable	Punctured	Mesentery	1 liter	1	....	Pain in epigastrium.
36	Pean.....	F.	26	Umbilical region	.....	Between layers mesentery	10 liters	....	1	Amenorrhœa for 3 years. Died 3d day from peritonitis.

37	St. Thomas Hospital Rep.....	M.	35	Umbilical region, lower abdomen	Evacuated	Between layers of mesentery	30 oz.	1	....	Tumor noticed for 5 mos.
38	Speckert.....	F.	29	Med. line umbilical region and to right. Freely movable	Extirpation	Mesentery	2½ liters	1	....	Pain in epigastrium. Sick 4 mos. Abdomen enlarged. Pain at defecation.
39	Brinsmade.....	M.	32	To right of umbilicus	Ruptured, accidentally; drainage	Degenerated mesenteric gland probably	Fœtal head	1	....	Ruptured by finger while exploring wound 4 days after operation for gangrenous appendicitis. Partial intestinal obstruction immediately relieved.
40	Brinsmade.....	M.	18	Umbilical region extending toward pubis	Cyst-wall sutured to abdominal wall. Incision, drainage	Mesenteric gland	10 oz.	1	...	Indefinite history of injury. Slight abdominal pain, for three months, after eating. Acute symptoms for 7 days. Omentum adherent to cyst.

AUTOPSIES.

41	Enzmann.....	F.	77	.....	.....	Thoracic duct	.....	....	....	Walls thick and flabby. Died of endocarditis.
42	Rokitansky, ...	M.	53	.....	.....	Mesenteric gland	.....	....	....	Several small, one large cyst.
43	Virchow.....	....	....	.....	.....	.....	.....	....	....	Multilocular chyle cysts.
44	Rokitansky.....	M.	36	.....	.....	.....	.....	....	....	Chyle cyst.

There was dulness on percussion over the tumor and resonance all around it. The tumor felt tense and apparently fluctuated. The patient's temperature was 100 and his pulse 120. It was evident that he needed surgical assistance and he was sent to St. John's Hospital.

On opening the abdomen over the tumor, we found a large fluctuating cyst with the omentum adherent to its anterior surface for a space of two inches. After freeing this attachment the tumor was easily lifted up into the wound and found to lie between the folds of the mesentery. There were many dilated blood vessels on the surface of the cyst. The tumor had narrowed the calibre of the intestine by flattening it out. After attaching the wall of the cyst to the parietal peritoneum it was incised and drained of about 10 ounces of milky fluid. The inside of the cyst was gently cleaned with gauze sponges and a gauze drain inserted. The wound discharged a very small quantity of chyle during the next three days, then rapidly narrowed down to a sinus. The patient left the hospital on the eleventh day at his own request. He returned to the out-patient department a few times. The sinus gradually closed and he is reported to have been well since that time.

This case is fairly typical of most of the reported cases.

The report on the specimen showed a creamy white or yellowish fluid, alkaline in reaction, with a specific gravity 1018. White corpuscles were present in large numbers. Fat globules were also present in large numbers. There was a large amount of fine granular amorphous material.

I have tabulated forty-four cases, including my own, for reference. There are other cases reported and referred to in the article by Speckert.[38] Seven of these cases are referred to by Carson.[11]

From an examination of this table it will be seen that chyle cysts of the mesentery occur at all ages. Three of the forty cases here reported are probably congenital, and the oldest patient was in his eightieth year. The cysts occurred about equally in males and females.

Two deaths occurred in cases not operated, and one death

in a case in which the operative procedure was not noted. One case in which the entire abdomen was implicated, died of shock. Another case died six weeks after operation in convulsions. The remaining thirty-five cases were treated surgically. Incision and drainage were practised in eighteen cases with no deaths. Extirpation was practised in fifteen cases with five deaths; puncture was practised in two cases with no deaths. It will be noticed that several of the histories note increased pain after eating. This is explained by the increased activity of the lymphatic system at that time.

A comparison with the following statistics, published in Tuffier's article, is of interest:

Thèse de Klefstad, 1892, eighteen cases of chyle cyst treated surgically: 7 incision, 7 recovered; 10 extirpation, 8 recovered, 2 died; 1 puncture, 1 died.

Thèse de Deffains, 1894. Cysts of the mesentery treated by:

1. Puncture: 4 sanguineous, 3 recovered, 1 died; 2 serous, 1 recovered, 1 died; 1 hydatid, 1 recovered.

2. Extirpation: 7 chyle, 6 recovered, 1 died; 7 serous, 6 recovered, 1 died; 2 sanguineous, 1 recovered, 1 died; 1 hydatid, 1 recovered; 1 dermoid, 1 recovered.

3. Incision: 5 serous, 5 recovered; 7 chylous, 7 recovered; 2 hydatid, 1 recovered, 1 died; 1 sanguineous, 1 recovered; 1 dermoid, 1 recovered.

In conclusion we may say that chyle cysts of the mesentery are rare but may occur at any age, and may be of almost any size. In diagnosis they are hardly to be differentiated from other fluid tumors of the abdomen. They are freely movable and are found in the umbilical region. They are not true cysts, and no attempt at extirpation should be made. The safest procedure is to suture the mesenteric wall of the tumor to the parietal peritoneum, then incise, evacuate the chyle and drain.

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THE ETIOLOGY OF HYDRONEPHROSIS.

BY FAXTON E. GARDNER, M.D.,

OF NEW YORK CITY.

THE description of hydronephrosis in classical treatises gives hardly that satisfactory impression of unity one feels after reading a well known and coördinated chapter of nosology. It throws together a number of pathological conditions having but few common features. The list of causes is most heterogeneous: including, as it does, *malformations,* such as imperforations of the urinary tract, stenoses, kinks and torsions of the ureter; *compressions,* depending on an infinite variety of lesions ranging from embryonic remnants and abnormal arteries to tuberculous glands, with the prolapsed, gravid, fibromatous or cancerous uterus, and newgrowths of the bladder and prostate as most frequent causes; *obstructions,* by calculi, by tumors, *traumas, kidney mobility,* etc. And when the tedious enumeration is over, then comes the damaging admission that there are still other cases, the etiology of which is as yet unknown.

All these affections have but one anatomical substratum in common, namely, aseptic distention of the kidney; in all other respects, they differ widely. The pathology is not the same; nor is it even sometimes comparable between cases; for instance, what resemblance between a renal distention due to an imperforation of the urethra and one ascribed to the crossing of the ureter by an anomalous blood-vessel?

The evolution is different: the gravity varies greatly and so do also naturally therapeutical indications.

This wholesale linking of all distentions of urinary ducts by an amicrobian liquid, whatever may be the primordial cause of the trouble, has no advantages whatsoever. It has, on the contrary, numerous drawbacks, especially from the therapeutical standpoint. How can we consider fruitfully in a same paragraph such radically different operations as the

removal of a uterine fibroid, the extraction of an impacted stone, and a plastic operation on the pelvis and kidney?

Such a medley is, however, bound to stay as long as text-books give the following simple and elastic definition of hydronephrosis: A distention of the pelvis and kidney by aseptic urine. This definition is incomplete and misleading, because too comprehensive in one way, and too narrow in the other.

It is too comprehensive. Of the two requisites of a good definition it fills only one,—it applies *toto definito* but not *solo definito*: all hydronephroses are renal aseptic distentions, but not all sterile distentions of the kidney deserve the name of hydronephrosis, or else the chapter on hydronephrosis becomes a mere chapter on general pathology.

It is too narrow, because it would lead us to believe that only those collections containing *urine* may be classified as hydronephroses. The contents of a true hydronephrosis are undoubtedly urine at first, but only for a limited time; in old cases the chemical composition is markedly changed; the liquid may become bloody, flaky, turbid, and the condition still be a genuine hydronephrosis.

For the sake of clearness, it is desirable to split the group of affections hitherto described as hydronephroses, and to try to delimit the class of cases to which we might rightfully restrict the name. This is not very easy to do, but when it is done, we find that we have separated a most important group, showing some homogeneity in the etiology, the clinical appearance, and also the treatment.

The specific difference of the cases of aseptic renal distention we want to bring together under the name of hydronephrosis, is that in those cases said renal, or rather renopelvic, distention is a disease *in itself* and not simply an accessory and secondary phenomenon in the course of another disease.

If we apply this principle, first we strike out all those cases in which the distention of the kidney is merely a part of a generalized distention of the urinary tract. For instance, in stenoses of the urethra, renal distention is a relatively

common occurrence, if the obstacle to urinary flow is sufficiently marked. It may occur in acquired strictures, but is more frequent in malformations, valvules of the urethra or septal duplicity of the bladder. Then the obstructive agent acts through vesical retention, the distention is bilateral and progresses gradually upwards and finally reaches the kidney. Is it logical to call hydronephroses and consider as a special disease this last stage, this ultimate result, of vesico-ureteropelvis distention? . . . .

Let us also put aside all cases in which the urinary distention, though localized to the upper urinary tract, perhaps even to one ureter and one kidney, is only an epiphenomenon, a complication, in the evolution of an altogether different disease. In this class of facts, we place many of the compressions, such as those exerted by pelvic or gynæcological tumors. In many cases, as in carcinoma of the uterus, of the prostate, the vagina, the rectum, renal distention is only accessory, overshadowed as it is by the extreme gravity of the primary affection. In other instances, as in fibroids, procidentia uteri, ovarian cysts, or in those rare cases of renal distention caused by peritoneal exudates or tuberculous glands, the mutual relations of the cause and the resulting hydronephrosis are not exactly the same; the condition of the kidney may acquire a very high prognostic significance, and change an operation for the relief of the above-mentioned lesions from a harmless procedure into a very hazardous enterprise.

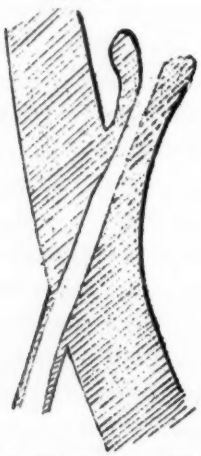
When we have thus cleared the field of a tremendous amount of material, exceedingly interesting indeed from many standpoints, but which must be sorted out under several other pathological headings, where it rightfully belongs, what is left? A class of cases in which the renopelvic distention is the chief feature of the disease, the dominating and essential element. *Anatomically,* the distention is limited to the pelvis and calyces, though sometimes it affects the ureter also, but the dilatation of the latter canal remains accessory. *Etiologically,* all those cases result from non-malignant alterations of the ureter, more particularly defects of its upper segment.

Symptomatically, they are all characterized by a tumor, in the clinical sense of the word, said tumor varying considerably in size. *From the standpoint of prognosis,* they are all benign; *therapeutically* and, last, they all require an intervention on the urinary tract. Consequently, we find between those cases enough similarity to feel justified in uniting them in one group. To that group we restrict the name hydronephrosis.

The narrowing of the scope of hydronephrosis will naturally cause a parallel shortening of the etiological list.

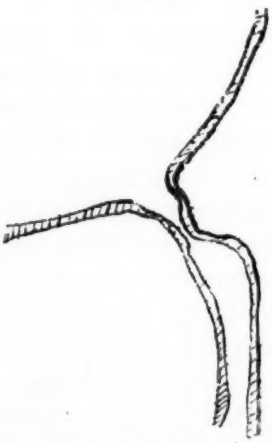
Of the two classes established by a time-honored division, viz., congenital and acquired, the latter class is much the heavier loser; it loses all pelvic benign tumors, all malignant new-growths and a few rarer causes of compression, while the congenital class loses only the hydronephroses due to an imperfection of the lower urinary tract, which are comparatively unfrequent.

FIG. 1.



Congenital malformation (Gerster).

FIG. 2.



Congenital stricture (Moynihan).

But, aside of this limitation, the class of acquired hydronephroses is doomed to lose many more cases which will change sides and array themselves in the rival class. For instance, many of the hydronephroses, formerly attributed to kidney mobility, are now justly ascribed to congenital defects

of the upper part of the ureter. Again, hydronephroses caused by vascular anomalies of the kidney must be switched to the congenital group, though their lot has been heretofore cast with the other.

Thus, the class of congenital hydronephroses which, fifteen years ago, was still deemed the lesser and was supposed to contain only pathological curiosities, towers to-day above the other; and each dismemberment of the latter enriches it.

It is not intended to give here an exhaustive study of all possible causes of hydronephrosis. We propose to dwell longer on some of the disputed points, insofar as it can throw some light on that all-important and final aspect of all medical problems, namely, treatment.

CONGENITAL HYDRONEPHROSES.

All these are caused by a congenital imperfection of the ureter. Such an imperfection is an abnormality. Therefore, the best start in a study of the question is a review of the development of the ureter. We shall expose here whatever is needed for a good comprehension of our subject.

The ureter springs as a dorsal evagination of the caudal end of the Wolffian duct. Said evagination ascends in the mesoderm and, while ascending, ramifies. Its offshoots form the pelvis and part of the kidney. Whether they form the whole of the latter, or, what is most likely, only the excretory part, the secretory elements being derived from another origin, is immaterial here; but a movement the ureter executes, or seems to execute, around the Wolffian duct, is very interesting. The ureter is first on the dorsal side of the duct; it successively becomes dorsal and external and finally ventral. The amplitude of the rotation is about 180°. Kuppfer denies that there is any real rotation, because, while the ureter seems to revolve around the Wolffian duct, the distance between the two is constantly increasing. But we must note that in this movement the vesical end stays fixed and that the upper extremity alone moves and therefore the duct cannot but become twisted around its axis. This rotation must be borne

in mind because its rôle in the production of some hydronephroses is certain, though variously estimated.

Much more important and less hypothetical are the facts we are going to consider now. At the end of the third month of intra-uterine life, the excretory organs have assumed their final shape; the primary and intermediate kidneys, pro- and mesonephros, and their excretory canal, the Wolffian duct, have vanished and henceforth urinary secretion, due allowance being made as to the quantity, is comparable to adult secretion. But the ureter is not then the smooth and rather uniform canal dissection shows in full-grown subjects. Its outline is exceedingly uneven: constricted segments follow dilated ones, and valvules formed either by the mucosa alone or by a folding-in of the whole wall of the canal, abound. These irregularities are not equally distributed in all points: their most common location is near the renal pelvis; next comes the segment near the bladder and, last, the middle portion; in one word, their elective sites are both terminal parts of the ureter.

Wölffler was the first to draw the attention to these points. In 100 newborns, he found 20 times more or less marked permanent transversal folds of the mucosa. In all of the 20 cases there were some valvules near the pelvic ureteral outlet, in a few cases some were found besides at a distance varying from a few millimetres to 1.5 centimetres from the vesical meatus. In ten instances, the jutting parts were prominent annular valvules, scarcely letting a filiform catheter pass through the duct. Said valvules, according to Wölffler, were formed simply by the mucosa.

But Wölffler's researches had not begun early enough. If, instead of studying newborns, he had examined fœtuses, he would have been brought to look upon those valvules, not as frequent anomalies occurring once in every five cases, but as constant temporary formations in the development of all ureters. This was ably brought to light by English. If we examine a lengthwise section of the whole duct, we notice the

following peculiarities: the pyelo-ureteral junction is always a narrow point; the immediately underjacent segment shows always a number of plicatures formed by a folding-in of the whole muscularis. The mucosa covers both sides of the valvule, but the external coat takes no part in its constitution; at the implantation point, the latter bridges over the gap between the two layers of muscularis constituting the valvule and the space thus delimited is filled up with connective tissue.

The number and size of those formations vary; sometimes single, sometimes multiple and placed in tiers one above the other along a short segment of the canal; sometimes low transversal ridges, sometimes real movable valvules, the free edge of which is tossed up and down by the urinary flow. Their implantation on the walls of the ureter is on a somewhat spiral line; hence the serpentine aspect of the canal. At the base of the fold, a little furrow may be seen on the outer coat and, here also, the superposition of these furrows makes the ureter appear as though it were spirally twisted around its axis. The valvules greatly reduce the lumen of the duct, sometimes to such an extent as to prevent catheterization with a hair. Pulling on both ends of the ureter causes the folds to flatten for the time being, but, as soon as the traction ceases, they reform, provided the outer coat has not been torn by too rough a pulling.

Besides these mucomuscular valvules, purely mucous formations are also found, particularly in the juxtapelvic segment of the ureter; some of these are vertical and radiate up into the pelvis where they array themselves in star-like figures. On a few of these mucous valvules without muscularis, papillary raisings have been found.

These three kinds of formations are *normal*,—we desire to lay stress upon the fact. They are always observed in the same part of the ureter, the rest showing none. They exist on both sides and are even almost always homologous; if, however, there is only a narrowing of the lumen on one side, valvules are found on the other. The plicatures take in both the muscularis and the mucosa, but not the outer coat, which

fact precludes the idea of acquired lesions; for in the latter eventuality, all three coats would be involved.

At the end of the third month of intra-uterine life, the ureters are thin cords tapering from the lower to the upper end with two markedly distinct segments; the lower is wider and grows faster than the upper which has no distinct lumen, filled up, as it is, by vertical mucous folds, and mucous, and chiefly mucomuscular, valvules.

All those projections disappear under the action of two factors: the eccentric pressure of the urine and the normal growth of the canal. When, during the fourth month of fœtal life, urine begins to flow through the ureter, the plicatures flatten, the narrow points widen, and the calibre becomes even. And at the same time, the length of the ureter increases markedly. The lower segment growing quicker than the upper, valvules persist where both sections meet, said meeting point corresponding to the pelvic ureteral outlet in the adult. Thus is the most frequent location of anomalies in the juxta-pelvic segment accounted for.

We easily conceive that, if normal ureteral growth is impeded by any cause, valvules will persist. The growth of the ureter being influenced by the same factors as the growth of the kidney, we readily understand why abnormalities of the kidney and of the renal blood-vessels are so frequently associated with imperfections of the ureter. An arrest of development of any part of the reno-ureteral system cannot but have its "*contre coup*" on the other parts.

Thus we account for the frequency of hydronephrosis in ectopic, movable, single, and horseshoe kidneys. This explanation is much more logical than the change of direction of the ureter generally given as the reason of retention in horseshoe kidneys. As for movable kidneys, the question is more complex and will receive due attention later; many movable kidneys are congenital; but some are not.

The two above-mentioned influences work still after birth and tend to perfect the shaping of the ureter almost up to adult life. Newborn infants and young children still present

a variety of slight ureteral defects, while in full-grown subjects all pelves show a fairly uniform type.

After this summary of the development of the ureter, how can we but think that in the persistency of one of those fœtal dispositions lies the cause of most congenital hydronephroses? The constancy during intra-uterine life, the frequency at birth, are weighty arguments and there is ample evidence to prove that the so-called normal strictures of the ureter are traces of those transitory folds.

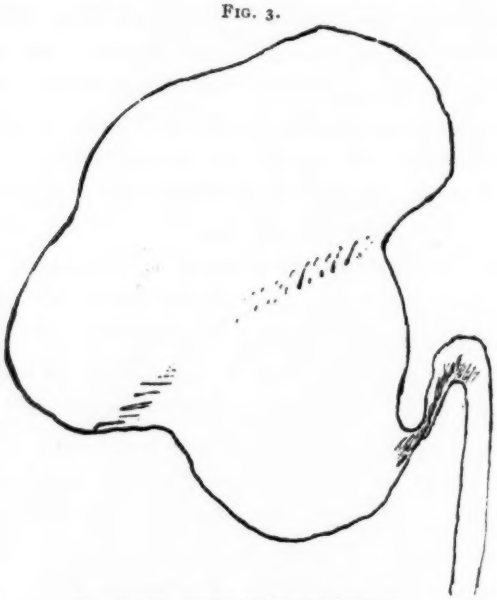
Let us now enumerate briefly the different classical causes of congenital hydronephrosis. It is wrong to make *absence* and *multiplicity* of the ureter head the list; for neither can be a cause of hydronephrosis. We have already stated that no hydronephrosis is possible when the ureter is absent. The two or three cases on record of hydronephrosis supposedly belonging to that type are old cases and are probably based on an erroneous interpretation of facts.

Nor can *multiplicity* be a cause of retention. I do not know of any more fascinating study for those who love to delve into embryological puzzles, than that of the development of supernumerary ureters; but it would lead us too far from our path and it is only indirectly connected with our chief subject. Enough is it to say that the anomalous ureter represents, most likely, in women, the Wolffian duct, in men, the Müllerian duct. This accounts for the common termination of said ureter in the utriculus prostaticus in men, in the upper vault of the vagina in women. It may be easily understood that such an important anomaly is frequently accompanied by defects in the calibre, particularly by atresia of the lower opening. Then hydronephrosis develops; but when the diameter is normal, a supernumerary ureter cannot cause any retention. It may give rise to a special variety of incontinence; but in a majority of cases, it does not give rise to any symptoms whatever, and many a man has lived a long life without his anomaly being even suspected. In all but one of the published cases of partial hydronephrosis due to a stenosed super-

numerary ureter, the latter drained the upper part of the kidney, which upper part alone was distended (Rémy, etc.); Hochenegg's case is the one exception.

The preceding remarks apply integrally to *abnormal endings* of the ureter, the next cause we find on the classical list. Not the abnormal ending provokes hydronephrosis, but the frequently concomitant atresia, or the modifications the anomaly brings in the direction of the ureter: flattening of the duct, sharp bends, etc. . . . . In Walter's case, the ureter opened too high into the bladder and consequently its

FIG. 3.



Pseudo-stric ure by kink and adhesions.

intraparietal course was too obliquely ascending. In a case of Weigert's the opening on top of the verumontanum was very narrow and the corresponding kidney was a large uronephrosis. Needless it is to multiply examples; they are all alike.[1]

Kinks and *torsion* of the ureter are also causes of retrodistention of the kidney. Thomson, Roberts and Arnould

[1] Special mention must be made of *intravesical prolapse* of the lower end of the ureter, which is not exceptional, and is sometimes associated with hydronephrosis of the corresponding kidney.

explain kinks by the embryonal rotation of the ureter around the Wolffian duct. This explanation has generally been held as valid without discussion, but, when carefully scrutinized, it does not seem as illuminating as at first sight. Kinks are much more naturally explained by the persistency of the normal fœtal condition. What we have said above dispenses us from dwelling more on the point. But the rotation theory explains very well the torsions that are sometimes observed. We mean here *real* torsion, not the torsion so many authors have considered as a cause of hydronephrosis, but which is only an apparent, a *pseudo*-torsion. Real torsion is rare; we could find but four cases in the literature: the last one was published two years ago by Dr. Grégoire, who showed us the specimen. The ureter was plainly twisted around its axis, and the pressure of the liquid within the sac was at times sufficient to untwist it; hence intermittent evacuations. But specimens of that type are rather unique. What is commonly described as a torsion of the ureter is only a peculiar aspect due to the spiroid furrows that mark the implantation of valvules on the ureteral wall, where the outer coat bridges over the tucked-in muscularis. The same thing is well known in the cystic duct where Heister's valvules give a deceptive spiroid appearance while there is no real torsion. And furthermore we do not see very well how the ureter, attached to the kidney above, to the bladder below, can become twisted around its vertical axis. Torsion would be possible only if the kidney revolved also around its vertical axis. Hamonic has admitted the existence of such a displacement, but without quoting any definite examples, and he grants it is only slight; it must be so, because the renal pedicle would soon oppose it. In a case where no renal pedicle existed, Schede saw a real complete torsion (360°).

Anomalies in the calibre are much less frequently mentioned in clinical reports, and, nevertheless, they certainly constitute by far the most important group of causes of hydronephrosis. That this is due to the greater difficulty to detect them is evident, and that we see only what we have learnt

to see is a thread bare truth. They will be found in a very large number of cases, and have already been found whenever they were carefully looked for. *Valvules* are the most frequent, as might be naturally inferred from the development of the ureter. But there may be also plain *strictures* without valvules. We have drawn in Fig. 2 such a case, borrowed from Moynihan; the ureter was narrowed as if it had been tied with a tape. Fig. 1 represents a peculiar deformity seen by Dr. Gerster. Matthews Duncan and Carpenter have published similar cases. This stricture near the pelvi-ureteral junction seems simply an exaggeration of a normal anatomical condition: Bazy on his mouldings found it very often, and Byron Robinson, Poirier and others, have shown that that point is always, even in normal ureters, one of the tight passages.

Embryonal remnants of the Wolffian duct (Launay) or of the Müllerian duct (Reliquet and Mathias-Duval) are rare and deserve no more than a passing notice.

To the group of congenital retentions must be added unhesitatingly many of the cases formerly ascribed to kidney mobility, and hitherto classed among acquired hydronephroses.

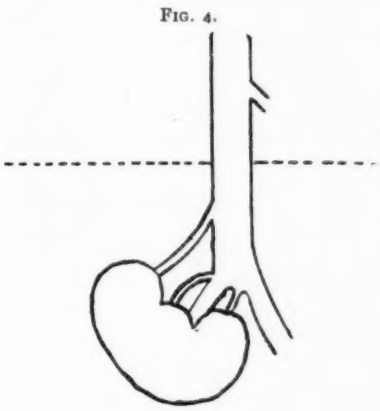
Kidney mobility is in most cases congenital. Figs. 4 to 7 show the four types of movable kidneys to which all others may be reduced. In the first type, the kidney is plainly ectopic, its blood-vessels are abnormal and have an abnormal origin. In the second, the movable kidney, disposed either vertically or obliquely, may sometimes be pushed upwards up to the lumbar fossa, but the origin of its vessels is still abnormal. In the third type, the kidney is vertical, the pedicle is much elongated and the vessels spring normally from the vascular trunks, while in the fourth the pedicle is short and the kidney oblique.

The two first types are unmistakably congenital; the third is also, while the fourth represents the typical acquired movable kidney. Consequently, if hydronephrosis develops on

account of kidney mobility in a kidney of any of the three first classes, it is a congenital hydronephrosis.

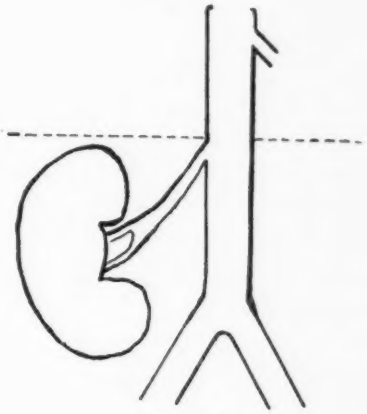
But this is not the only reason pleading for the change we are now considering. There is another, more important,

Fig. 4.



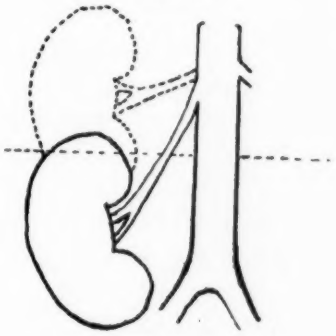
(Pasteau).

Fig. 5.



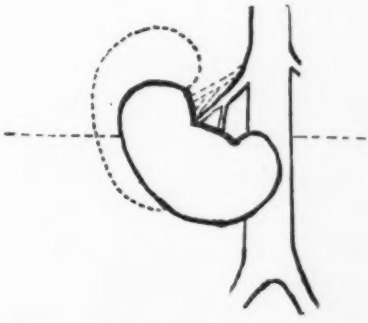
(Pasteau).

Fig. 6.



(Pasteau).

Fig. 7.



(Pasteau).

Different types of movable kidneys.

namely, that many of the retentions ascribed to kidney mobility *are altogether irrelevant of the latter* and are indeed due to some of those congenital defects the capital rôle of which we have already seen.

Such a view, very few years ago, would have been revolu-

tionary, but it is now fast gaining recognition. Since Landau's series of papers and since Terrier and Baudouin's work, it has been almost universally taken for granted, and believed almost as a tenet, that movable kidneys cause the type of hydronephrosis called intermittent.

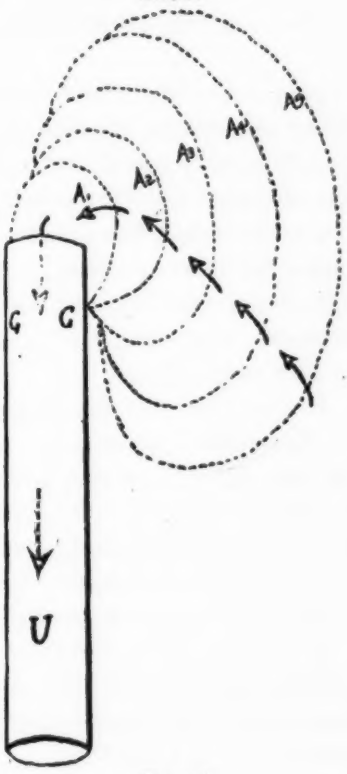
The latter is characterized essentially by crises of pain, accompanied by a progressively developing renal tumor, and by temporary oliguria; it ends by a more or less abundant evacuation of urine, while the tumor subsides. A very simple explanation is obvious. When the kidney falls, the ureter kinks, the flow of urine is mechanically stopped, the urine is retained in the kidney, hence the tumor and the oliguria; then later, the obstruction is removed, the accumulated urine is voided, hence the polyuria and the disappearance of the tumor.

Unfortunately for medical truth, this explanation is too simple, too elegant, too logical and therefore too alluring. It seemingly accounts perfectly for everything and makes further investigation seem superfluous. Here we have intermittent symptoms and an intermittent cause, the chronology of which seems to tally nicely together. How could one not be the cause of the other? And if difficulties arise when it comes to deciding as to the mechanism, many ingenious hypotheses can be brought forward and we can even describe more or less imaginary anatomical peculiarities to give our hypotheses a solid substratum. All this has been done in good faith, but nevertheless it is forcing facts into the frame of a theory, instead of enlarging the frame to make it fit the facts, or even casting it off, if the latter adaptation is not possible. The parallelism between renal displacements and intermittent hydronephrosis cannot stand a close scrutiny.

First of all, there is no special type of disease to which the name intermittent hydronephrosis properly belongs. Intermittence is not a characteristic of a *special* kind of retention; it is a common feature of all retentions; and is presented by all at some period of their development. *Hydronephrosis is not simply a distention of the kidney;* if it were, it might be truly intermittent; but hydronephrosis is more than that; it

is a distention with *progressive sclerosis* of the pelvic walls and of the kidney. Now the latter lesions are permanent. Consequently, what is intermittent is not the hydronephrosis, but only the filling and emptying of the sac. Now this has but a secondary importance and is not sufficient ground to establish a distinct type.

FIG. 8.



(Fenger).

Again, the polyuria which comes after the attack of pain is very often out of proportion with the size of the tumor. In some cases, the excess of urine voided over the normal amount reaches almost a gallon, while the tumor is comparatively small and certainly cannot contain such a quantity of liquid. Inversely, catheterization during the crisis has found sometimes not more than *one ounce* in the pelvis. This shows

conclusively that the supposed relationship between the filling and emptying of the sac and the growth and subsiding of the tumor, are only apparent. The polyuria is not due to the sudden evacuation of a renal retention. The increase in the size of the kidney is due in many cases to an intense congestion of the organ; when the congestion ceases, polyuria sets in, and the volume of the gland falls again to normal. The postcongestive hyperactivity of all organs is a well-known fact.

Beyond any doubt, many of the hydronephroses associated with kidney mobility are congenital, and are due to one of those defects we have already mentioned several times. We should prefer to believe that kidney mobility and hydronephrosis are completely independent from one another. Both are congenital defects: they are simply co-existant: hydronephrosis does not create mobility, any more than mobility creates hydronephrosis. We simply have to deal with an hydronephrosis *in* a movable kidney.

But is there no room left for hydronephrosis caused *by* kidney mobility? Extremists say no; but we think there is on the question a vast amount of clinical and experimental material which we have no right to disregard. No doubt it would be more satisfactory to the mind, always intent on uniformity, if it were proved that all hydronephroses associated with kidney mobility are in fact congenital hydronephroses, but this we do not believe to be rigidly exact. Certainly, retentions due to kidney mobility must be reduced enormously in number, but they must not be wiped out entirely. The point will be dwelt on later.

An argumentation much along the same lines applies to those cases of hydronephrosis commonly ascribed to pressure of an abnormal blood-vessel on the ureter. If such a pressure begets hydronephroses, the latter must be termed congenital, although, in text-books, they are generally classified among acquired.

In some cases of hydronephrosis, the ureter has been

found, near its origin, astride on an anomalous blood-vessel, an artery in most cases, a vein in a few exceptional instances. This is enough to have the question of causality raised.

The solution is not evident at first sight; the vessel may be the cause of the retention, but it may also have nothing to do with it, and simply have assumed connections with the sac secondarily as a consequence of the growth of the latter. In the literature cases may be found demonstrating both eventualities.

In all cases, the blood-vessel is *abnormal*. Anatomy tells us about several arteries which may come into contact with the first segment of the ureter. First, the lowest branch of the renal artery which goes to the lower pole of the kidney may separate prematurely and pass in front of the origin of the duct. Next, supernumerary arteries branching off directly from the aorta; in one out of every four cases, the vessel passes behind the ureter, in the three others it passes in front. Thus, in a vast majority of cases, the anomalous artery crosses the ureter *anteriorly*.

Can such an artery cause hydronephrosis? The older writers admitted it unreservedly; three mechanisms have been put forward: (*a*) intermittent compression by the arterial systolic impulse, (*b*) continuous compression as if by a fibrous tract, and secondary alterations of the canal, and (*c*) more particularly, kinking of the ureter on the vascular cord, determining either a sharp bend or a more or less open curve. Boogard, who observed the first case in 1857, thought even there might be in those cases a *true* intermittent hydronephrosis, the liquid accumulating till its pressure becomes high enough to overcome the arterial obstacle, and then emptying.

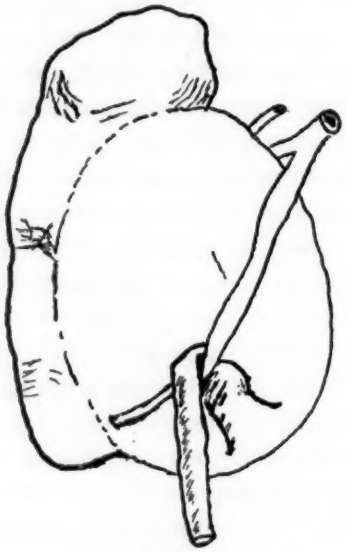
But this is not a matter of course, though apparently simple, and it is bitterly contested now.

English was the first to state that an abnormal artery passing *in front* of the ureter cannot possibly be the cause of a hydronephrosis, because it can never hook the ureter of a movable kidney. If the artery passes *behind* the duct, then

it may hook it when the kidney falls. This conception would reduce greatly the number of cases.

Küster, Israël, Bazy, Duval and Grégoire, concur. They even reject altogether the rôle of abnormal vessels in the production of renal retentions. As in several cases the presence of a ureteral malformation is expressly noted (Roberts, Morris, Decressac), they contend that *all* hydronephroses developed in kidneys showing an abnormal blood-distribution

FIG. 9.



(Decressac).

are due to such defects. They assert that *because* of the uronephrosis does the vessel come into contact with the ureter. Of course such a theory is tenable; kidney mobility, abnormal vessels and ureteral defects belong all three to the same class of errors of development and, when one exists, the chances are that some of the others exist also. But it is partly hypothetical and we think it is carrying the desire for uniformity too far.

From Bazy's own drawings, purporting to prove that a pre-ureteral vessel could not produce a retention, while a retro-ureteral vessel could, Pierre Delbet drew diagonally opposed

conclusions. And a peculiarity noted several times sustains the idea of hydronephroses *by* and not simply *with* abnormal vessels. Figs. 9 to 12 represent cases of this type. It may be easily seen that in 9 the dilatation of the ureter does not begin exactly where the artery passes over the duct. In some cases, the dilatation begins above the crossing point, in some cases it extends below. It is plain the artery is not then the cause of the retention. But, in some others, the crossing point marks exactly the beginning of the sac as in Figs. 10, 11, 12. Some authors account for this by saying that the crossing point is precisely the part of the ureter where congenital imperfections are most often met with, but is not this straining a point too far? When they assert that, in those cases, before proclaiming the primordial rôle of the artery, we must prove that there is not in the ureter a malformation, they forget that the burden of proof rests upon them and that *they* have to establish the rights of their claim. We, therefore, admit with the older authors, and with Legueu, Hartmann, Luys, Picqué and Carlier, the existence of hydronephrosis *by* vascular anomaly. Those cases are not very numerous, but they exist, and they raise a very interesting therapeutical problem.

ACQUIRED HYDRONEPHROSES.

This group as described by classics is the larger, but also the more heterogeneous, of the two. Our definition of hydronephrosis splits it and, with compression cases, takes away more than half of its clinical field. Furthermore, it has been steadily decreasing with the inroads of congenital lesions in its domain; it is now very much reduced, but it is not as near evanescence as some would have us think. It still takes in a very respectable number of cases dependent on the following factors: acquired movable kidney, cicatricial lesions of the ureter, impacted stones, and more rarely inflammatory changes of the duct, ureteritis and peri-ureteritis.

This list is not long when compared to the older ones, but it is sufficient to give acquired hydronephrosis an honorable place in nosology.

Acquired movable kidney is a cause of hydronephrosis, though we have already seen that it is by no means as frequent a cause as has been contended at a time.

Experimentally, Tuffier succeeded five times out of nine in producing hydronephrosis by making the kidney movable. But there is one requisite well demonstrated by Legueu, Hildebrandt and Haga: that the upper ureter *be fixed.* If it is not, no hydronephrosis can be obtained. Paul Delbet was so impressed by the latter fact as to view ureteropyelitis as the only real cause of hydronephrosis; but his, like all extreme theories, contains some truth, but overshoots the mark, and gives too much weight to a single etiologic factor.

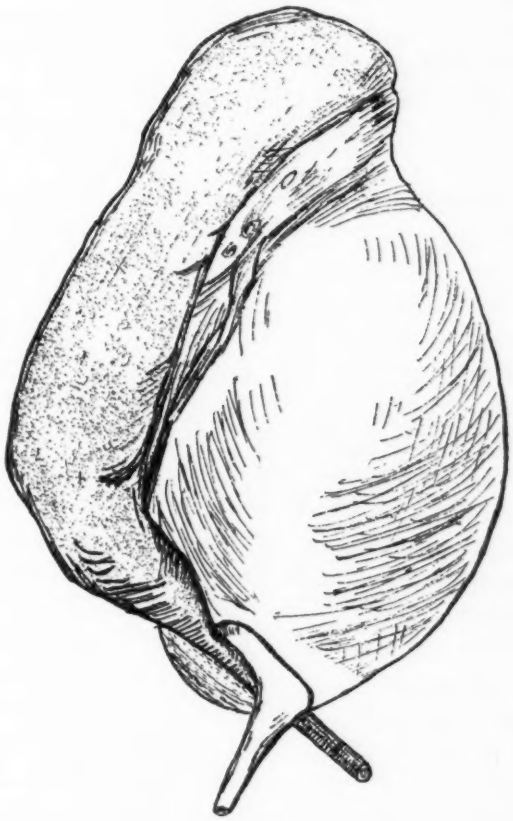
If kidney mobility may under some circumstances provoke hydronephrosis in animals, why should it not do it in man? All agree that a slight obstacle to urinary flow is enough to cause a retention. Why deny the same right to kinks of the ureter, constant in cases of movable kidney? Ureteral catheterization shows the presence in the pelvis of simple movable kidneys of small retentions varying from two drachms to an ounce or more. May we not rightfully consider these as the starting point of larger accumulations? Those who want to find at any cost a congenital malformation at the origin of every hydronephrosis do not let such minor facts nettle them. They say those small retentions are not hydronephroses, because they lack an essential element,—namely, sclerosis of the walls of the sac. But do not even congenital hydronephroses go at first through an initial stage when sclerosis of the walls has not yet begun? A retention does not, from the outset, contain a pint of liquid; it must begin by a few drachms or an ounce.

Willing, as we are, to grant that many hydronephroses hitherto ascribed to kidney mobility, are really due to congenital defects; that movable kidney is itself, in a great majority of cases, a congenital disease, we still stoutly defend the existence of acquired hydronephroses, caused solely by the mobility of an acquired movable kidney.

Wounds of the ureter are not common, but the resulting scars are so constituted that the risk of retrodistention is

great. Judging from the nature of the healing process, stenosis seems an unavoidable contingency and experimental and clinical surgery of the ureter gives corroborative evidence. In the scar, the anatomical elements are atrophied and lost in a dense connective tissue which forms almost the whole of

FIG. 10.



(Luys).

the ureteral wall and even, in some cases, extends considerably beyond, and gives rise to diffuse sclerous peri-ureteritis, thus greatly aggravating the stricture.

A wound of the ureter may be produced from within by a stone; we shall have to discuss later calculous hydronephrosis. It may also be produced by a cutting or pointed instru-

ment; but, in the latter case, hydronephrosis is an exceptional occurrence. A urinary fistula is a much more common sequel; among hydronephroses, we found but one case, Soller's, concerning a man who was struck in the lumbar region in 1870, during the Franco-German war, by a splinter of a shell, and at whose necropsy, ten years later, a stricture of the left ureter with a large hydronephrosis was found.

Most cases of acquired strictures of the ureter are observed after *deep contusions of the loins.* This brings us to discuss the question of *traumatic hydronephrosis,* a very moot question which, however, seems to be nearing a definite solution.

Most of the cases described as traumatic hydronephroses may be summarized thus: an individual, a man or a child in most instances, falls from a height, the lumbar region striking against a hard prominence; or gets run over by a vehicle, a wheel of which passes diagonally in the costo-iliac space. Right after the accident, the usual symptoms of renal contusion are present: more or less severe pain, shock, hæmaturia. A few days or a few weeks later a large tumor is felt, extending horizontally from the side to the median line, vertically from the hypochondrium to the iliac fossa. Said tumor is *not* heralded in, we insist on the fact, *by either pain or a change in the general condition* of the patient. When tapped, it yields a considerable amount of a yellow, transparent, urine-like liquid. After the tapping, the tumor forms anew and it becomes necessary to thrust the needle again, three, four, or more times before a cure is effected.

Such is the history of the princeps case reported by Hawkins in 1834; such are the more recent reports of Stanley, Hicks, Vincent, Cropt, Cabot, Nové, Josserant, Froelich and others.

On such a foundation, some writers build a clinical type denominated traumatic hydronephrosis and establish a theory to explain how it is brought about. They take it for granted that the accumulated fluid is really *within* the renal cavities.

The obstacle to urinary excretion is peri-ureteral hæmatoma pressing on the duct. The above-jacent portion of the

ureter dilates and kinks and thus the obstruction becomes complete.

But, supposing this theory had an anatomical confirmation, which it has not, we would still wonder how such a rapid and large dilatation of the pelvis and kidney could be possible. Here we have a most unusual feature; never has such a distention as is noted in the clinical reports, been produced in so short a time. Clinically, it takes years before a large hydronephrosis is constituted; experimentally, renal distention follows ligation of the ureter, but never do experimental tumors attain such a huge size. Many searchers have ligated the ureter; I have done it myself several times in the course of experimental work directed along other lines, but I have never seen anything approaching the dimensions of the so-called traumatic hydronephroses.

Another fact deserves attention. These enormous distentions of the pelvis, if such they be, develop without pain. Oftentimes they are detected only because surgeons, after a renal contusion, are wont to palpate the injured region. Now, let us catheterize a ureter and inject some liquid in the pelvis and distend it, ever so little; before five seconds, the patient will be howling and writhing. I have seen it many times. Sinitzine and Albarran have demonstrated the fact long ago. Rapid distention of the pelvis is extremely painful; and some would have us believe that enormous hydronephroses can develop painlessly in a few days! And also that those enormous hydronephroses may be cured by simple tapping!

Therefore we find so far in the theory of traumatic hydronephrosis a mere hypothesis lacking anatomical support and presenting several weak points in opposition with well established facts observed time and time again.

Now, what do direct anatomical findings teach us? Hawkins, whose christening of his first case as hydronephrosis was responsible for the birth of the above-exposed doctrine, states himself expressly that, in his case, the volume of the kidney was *normal;* that the flexuous and elongated ureter inserted *normally* on the pelvis and had no connections whatever with the cyst containing the fluid; said cyst being *sub-*

peritoneal and *pararenal,* but altogether *independent* from the kidney. Is this a hydronephrosis? It might have been considered as such in 1834 when the terminology was lax, but nobody would keep the name to-day, not even with subcapsular as a corrective. The same independence of the kidney and ureter from the collection is noted in all cases of traumatic hydronephroses which came to operation or necropsy. This, coupled with some other findings, and the nature of the fluid, will give us the key of the problem.

The finding just alluded to is the frequent injury of the pelvis and ureter. Two tears existed in the pelvis in Hawkins' case, one in Vincent's. Barker found a hole in the ureter and Chaput saw the latter completely torn off. The kidney itself is, as a rule, uninjured, and this accounts for the infrequency of hæmaturia much better than the weak reasons given by the partisans of the clot theory.

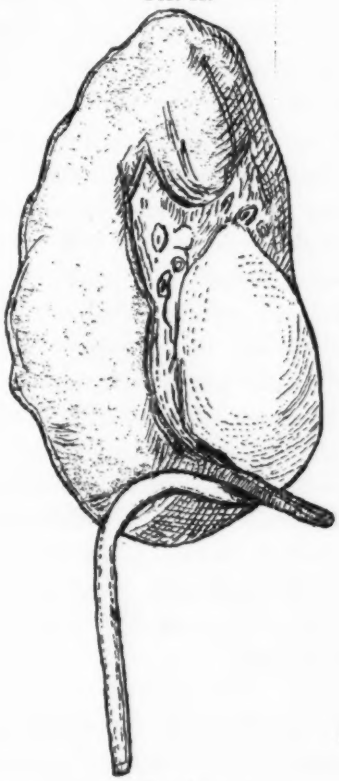
The liquid withdrawn by tapping is *urine;* of course, not exactly normal urine, but nevertheless easily recognizable as such.

Let us now simply enumerate the three above-mentioned characteristics and we shall reach the true definition of these post-traumatic tumors: an *extrarenal* collection *of urine,* produced by an *injury of the pelvis or ureter.* Now we grasp at once the why of the painlessness and of the quick growth of these tumors. Here we have a normal kidney, secreting normally, and pouring its secretion into loose connective tissue in which a pouch may be readily excavated. While studying the effects of puncture on the pelvis and ureter, we had many occasions to see how painlessly the largest collections develop without any effect on the general condition.

That the acute, almost sudden, development of a genuine hydronephrosis, after an injury, is impossible, is our firm belief. However, there are scattered in the literature a certain number of cases in which the truly hydronephrotic nature of the tumor is undeniable. Thus Schede says he saw a tumor appear six days after the accident: an operation and a post-mortem showed it was a true hydronephrosis. Barling's case

is similar; it occurred a few days after the patient had slipped while getting into his bed. Fenger's patient had made a violent effort dismounting from horseback; and, last but not least, ten days were enough for a hydronephrosis to appear in one of Richardson's patients after the trifling exertion caused by the rolling of a barrel.

FIG. 11.



(Luys).

The *post hoc, ergo propter hoc,* character of these deductions is obvious. These cases must be construed as cases of latent hydronephrosis discovered because a trauma drew the attention to the loins. The slightness of the injury in many instances makes us suspicious as to its etiological rôle.

But is there nothing that may be called traumatic hydronephrosis and must we scratch the name from medical nomenclature? We do not think so. If a lumbar contusion cannot

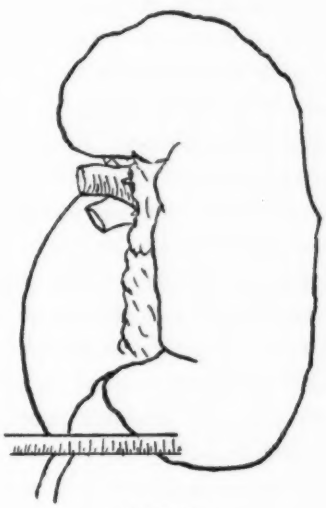
produce hydronephrosis itself, it can very well cause a stricture of the ureter. The symptoms of hydronephrosis will appear after a certain interval, four months, six months, several years. The interval was six months in Dr. Gerster's remarkable case which enjoys the distinction of pertaining all at once to a traumatic stricture, to a congenital malformation, to one of the first conservative attempts ever made, and also to the youngest patient on record among those treated by conservation; unfortunately after six months' success, a sinus reopened, pyelonephritis set in and nephrectomy had to be performed. Shall we say, with some writers, that the latter facts are not *traumatic hydronephroses,* but should be styled *hydronephroses secondary to a traumatic stricture* of the ureter? This might be a subtle distinction, if it were more than a mere quibble. If it was sustained, we could call congenital only those cases in which the tumor is fully developed at the time of birth; all others would have to be styled hydronephroses secondary to a congenital lesion of the ureter. Calling, as we do, congenital, all lesions relevant of a congenital condition whatever may be the time of onset of the symptoms, we must call traumatic all retentions caused by a trauma, even if the latter acts only indirectly and tardily through the medium of a stricture. And, to sum up tersely the etiologic rôle of injury in the genesis of hydronephroses, let us say: *immediate traumatic hydronephrosis cannot and does not exist, late traumatic hydronephrosis does exist.*

There have been many ups and downs in the history of *calculous hydronephrosis.* In turns, it has been considered without sufficient grounds as very frequent, and its existence has been almost flatly denied.

When a rather large sized stone is found impacted in the ureter while the corresponding kidney is dilated, a natural enough inference is that the calculus is the cause of the hydronephrosis; it was the opinion of all the earlier writers, Rayer, Morris, and was still admitted without dispute by Newman in 1888. The stone was supposed to act either as a valve or a

plug when its size made it unmovable. It is very likely that many hydronephroses described as calculous on the sole strength of the co-existence of an impacted stone, do not deserve the name; but much of the criticism aimed at calculous hydronephroses seems to bear upon secondary questions. Thus Arnould rejects all cases in which the content of the sac is not exactly like normal urine. Such an exclusion is arbitrary, because we know the liquid contained in a hydronephrosis may become reddish, flaky, even turbid, and yet remain sterile. Legueu refuses the name of calculous hydronephrosis to all

FIG. 12.



(Legüeü).

cases in which bacteriological tests have not peremptorily established the perfect asepsis of the contents. This also, although logical, is arbitrary; such a stringent rule may be theoretically right, but practically the difference between a strictly aseptic sac and the same when it is slightly infected, is not so great as will warrant placing those two stages of the same condition in two different classes. There are no such sharp lines in biology. Such requisites cut down Newman's 51 cases to 2 (Antona, Stevenson). But neither Arnould nor Legueu enters into the real merits of the question: can a stone produce an aseptic distention of the kidney, and, if it does, how

does it act? They argue on contingencies and their ostracism is as far from scientific truth as the first observers' hasty conclusions.

It is impossible to deny that a stone impacted in the ureter can produce hydronephrosis. Clinically, the causal relation is proved by the cure of retentions after simple removal of the calculus. Experimentally, Ebstein and Nicolaïer produced renal calculi by feeding oxamid to dogs and Tuffier and Navarro, while using the method with other ends in view, obtained incidentally a few retentions.

But the number of calculous hydronephroses, though much higher than thought by Arnould and Legueu, remains nevertheless small as compared with the number of renal and ureteral stones. Hydronephrosis is not the ordinary result of stone impaction in the ureter; atrophy and sclerosis of the kidney is much more frequent, as the general pathology of duct calculi would lead us to think, and as every surgeon who has occasions to see many cases of aseptic lithiasis knows. Therefore, some peculiarities are necessary in order to have a stone cause a retention. Careful analysis of the cases elicits a few of them; but sometimes nothing out of the ordinary is found. For those cases, the old theories are alone acceptable and why should not they be accepted since a partial obstruction is admitted by all surgeons as the only necessary cause for the production of hydronephrosis?

However, there are here no fast rules governing the development of retentions. Neither the shape or volume, nor the number, nor the seat of the concretions, are decisive elements. Hydronephrosis is sometimes seen with stones of the size of a filbert; while there was no retention in Israël's case with a huge ureteral calculus seven inches long and more than one inch in diameter. One stone is enough in many cases, while 16 in a case published by Morris had not caused the pelvis to dilate. Why there should be such variations is not always discernible.

In some reports, the co-existence of a congenital malformation is noted (Fenger, Perkins, Morris, three cases of Léon Bernard). It is more than likely that stone and malformation

helped each other constitute an obstacle, while each one taken separately might perhaps not have impeded the flow of urine.

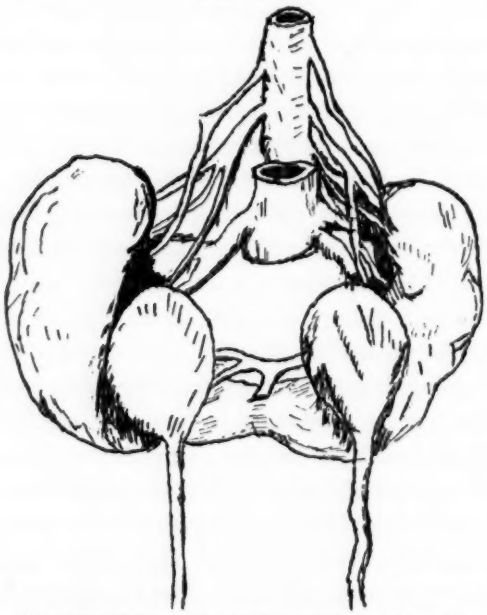
In some other instances, a similar aggravating rôle is played by acquired alterations of the canal. When a stone moves through the ureter, it certainly scratches the walls, and more or less deep traumatic lesions are a natural consequence, despite the statement of many writers that calculi are harmless for the duct through which they are expelled. But in most cases, these lesions heal quickly and well. Sometimes, however, a stricture is the result; when it is formed the next stone will stop there and a sufficient obstruction will be realized. Barker, Israël, Ledentu, Albarran, have seen cases of this type. Bernard has seen, in newborn infants, four calculous hydronephroses caused, not by common stones, but by deposits of uratic sand in the kidney; and he raises the question if some of the supposedly causeless hydronephroses in adults are not sequelæ of an infantile undiagnosed lithiasis. But it is noteworthy that, in three out of his four cases, there were malformations of the ureter and maybe, after all, his were congenital hydronephroses also.

The popping in and out of the stone has been proposed by Lancereaux as an explanation for some cases of intermittent hydronephrosis. It reminds one of an old-time theory of recurrent appendicitis based also on intermittent poppings of fecal concretions. However ingenious the idea, it does not stand examination. We have said that there was no special type deserving the name of intermittent hydronephrosis; consequently we need not dig out of our imagination mechanisms to account for its production.

Inflammatory lesions of the ureter do not rank as frequent causes of hydronephrosis for the very plain reason that if the ureter is infected, the chances are that the pelvis and kidney are also; pyelo-nephritis or pyonephrosis, not hydronephrosis, is the logical outcome. But, if the infective process is slow and very much attenuated, hydronephrosis seems to be a bare possibility. *Ascending tuberculous ureteritis* has been incriminated; but cases remain few and far between. To our knowledge, four cases only are on record, all French (Lancereaux,

Albarran, Répin, Legueu). The ureter is sometimes still pervious, but, in the majority of cases, it is occluded. And maybe the name hydronephrosis does not fit exactly those cases; not unlikely, they are healed tuberculous kidneys and distention is only the trace of the old disease. They depend more on destruction of the parenchyma than on distention of the pelvis, and consequently are pseudohydronephroses, akin to renal atrophy more than to real hydronephrosis.

FIG. 13.



Horseshoe kidney. Double uronephrosis. (Hauser).

Peri-ureteritis is more important as an etiologic factor. It is very frequent in the upper part, where it changes temporary bends into permanent kinks. It has been stated above that, without the fixity of the upper segment of the ureter, no hydronephrosis could result from kidney mobility. In the lower part, peri-ureteritis is not as frequent, but it is observed sometimes: the duct, encircled in a hard fibrous ring is narrowed and possibly deviated from its normal course; the destruction of the band and the straightening of the ureter are needed for a cure of the retention.

Here ends our list of the causes of hydronephroses. The official list still includes curves, kinks, flexuosities, torsions, acquired valvules, oblique and high insertion of the ureter, but these are direct *consequences* of the pelvic distention and not its causes. So thought already Simon (of Heidelberg), the father of renal surgery, and his opinion has been vindicated by Albarran and Legueu's experimental work. All those who have ligated ureters know that the first effect of ligation is a sagging of the upper part of the ureter and the development of flexuosities. Fenger has taught us how the high and oblique insertion of the ureter is a consequence of the development of the retention, as well as the valvule near the ureteral opening, which, it must be noted here, is thoroughly different from a congenital valvule. (See Fenger's diagram, Fig. 8.) Torsion has already been referred to.

Such are the views on etiology of hydronephrosis we have derived from the observation of numerous enough cases, which it was our good fortune to see, and from painstaking study of the literature on the subject. Maybe we do not show as exclusive preferences in the choice of our theories as most writers. But what is most needed in the study of the etiology of hydronephrosis is good judgment and impartiality. Strange to say, almost all writers seem to have extreme opinions. Fifteen years ago, almost all hydronephroses were considered as acquired; since the frequency of congenital defects began to be recognized, the wind has shifted and many writers seem now bent on demonstrating that all are congenital, while some few remain staunch uncompromising supporters of the old belief. One way is as unscientific as the other. A theory, even a pet one, ought to always remain subservient to facts. Facts show conclusively that the etiology of hydronephrosis cannot be reduced to the new slogan, "arrest of development," any more than it could be to the old, "kidney mobility." Truth lies midway between extremes, "*Suum cuique.*"

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 13, 1908.

The Vice-President, Dr. Ellsworth Eliot, Jr., in the Chair.

VOLKMANN'S ISCHÆMIC PARALYSIS.

Dr. George D. Stewart presented a boy, 7 years old, who on November 17, 1907, fell, receiving a supracondyloid fracture of the right humerus. A temporary wooden splint was applied at Bellevue Hospital, and the patient was sent home, where he was seen the same evening by the family physician, who reduced the fracture under anæsthesia and applied a triangular splint. On the second day the hand was swollen and blue. The dressings were changed, and it was then noticed that the power of flexion was interfered with. This, however, was attributed to the œdema. After gentle massage, splints were lightly re-applied. Treatment thereafter consisted of daily dressing, with gentle massage, for the purpose of reducing the swelling. On the third day a pressure sore developed on the flexor surface of the forearm, immediately below the elbow-joint. The child suffered a great deal of pain during the first few days after the injury. On December 12, 1907, there was a profuse secondary hemorrhage from the pressure ulcer. Paralysis of the flexors, with inability to extend the wrist and fingers, was then well marked. A week later, Dr. Stewart saw the patient in consultation, and made a diagnosis of ischæmic paralysis.

On January 6, 1908, the patient was seen by a neurologist and an orthopædist, who suggested that although the nerves were apparently active, they might be impaired by callus of bone or scar tissue. Accordingly, on January 21, the patient was oper-

ated on by Dr. Stewart, and the median nerve was isolated for two or three inches above and below the elbow. Neither at the site of the healed ulcer, nor above or below it did the nerve appear to be compressed, but the muscular tissue had disappeared, and in its place there was a fibrous structure. The patient left the hospital, unimproved. Since that time, under exercise and daily massage, he had improved slightly. His condition, on the whole, however, remained the same.

Examination at the present time showed a typical ischæmic paralysis, as described by Volkmann. In this case, as in the majority of recorded cases, the location of the fracture was in the lower part of the humerus. The causative factors were probably damage to one of the vessels, likely the ulnar; pressure from the lower fragment of the humerus; and pressure from the application of splints. There was marked atrophy of the muscles of the forearm, particularly the flexors, and the muscles had a board-like sensation. Motion at the elbow-joint was very limited, due to the fracture; the forearm was pronated and the fingers were flexed, giving a typical claw-hand appearance. When the wrist was fully flexed the fingers could be extended; when the wrist was extended, however, flexion of the fingers could not be prevented. Forcible extension of the fingers caused the flexor tendons at the wrist to become prominent. Touch and temperature sense had never been impaired. The muscles reacted to both galvanic and faradic stimulation, proving, according to Taylor, that the nerves were not damaged.

The fibrous degeneration which took place in these cases of ischæmic paralysis was no doubt very closely allied to the changes observed in the sternocleidomastoid muscles and contiguous structures in certain cases of so-called congenital torticollis, due to faulty position *in utero*, and a consequent ischæmia.

PRIMARY SARCOMA OF THE APPENDIX.

Dr. Stewart presented a man, 35 years old, a native of Greece, and a peddler by occupation, who was admitted to Bellevue Hospital on January 27, 1908.

Bearing upon his present illness, the patient gave a history of having had three similar attacks: During the first one, which occurred about a year ago, the pain was localized over the appendix, but was not very severe. A second similar attack had

occurred three months ago, and a third one four weeks ago. This was more severe than the previous attacks, and was accompanied by vomiting.

Present illness: On the night preceding his admission, after eating some cheese and olives, the patient experienced a diffuse, dull pain, constant in character, and located in the abdomen. He had vomited five times during the early morning, the vomitus consisting of undigested food; it was sour to the taste, but contained no blood. For the past three or four days his bowels had been constipated. On the day of his admission he had two watery passages which contained no blood. His pain had gradually increased in intensity. On admission, his temperature was 102; pulse, 100; respirations, 24. A blood count showed 16,000 leucocytes; 80 per cent. polynuclears; 8 per cent. transitionals; 8 per cent. lymphocytes; 1 per cent. mononuclears. On the following day the leucocytes numbered 12,200; polynuclears, 80 per cent.; transitionals, 5 per cent.; lymphocytes, 13 per cent.; mononuclears, 2 per cent.

Upon physical examination, the patient, who was well nourished and developed, was found lying on the left side with the knees somewhat flexed and the thighs drawn up. There was no vomiting; he did not complain of pain. The abdomen was normal in appearance; the respiratory movement was decreased, with slight general resistance. The upper half relaxed fairly well; the lower half was held more firmly, and deep palpation was resisted. There was a slight spasm in the region of the right lower rectus, where the stiffness was more marked than on the left side. He pointed to McBurney's point as the spot of greatest tenderness and pain. The liver and spleen were normal.

Operation, February 1, 1908: Upon opening the peritoneum, the muscular bands on the cæcum were followed to the tip of that organ, where they disappeared behind the peritoneum, or, more properly, behind adhesions. With the finger, a small mass was felt in the ileocæcal angle projecting forwards from the peritoneum on the posterior abdominal wall, and about one inch internal to the cæcum. The mass was taken, correctly, to be the tip of the appendix, and with the finger the supposed adhesions were broken up. The appendix was separated up to its cæcal origin, where it was ligated and removed in the usual way. The

patient's recovery was uneventful, and he left the hospital on February 19, 1908.

The pathological report, by Dr. Harlow Brooks, was as follows: The mass was composed of mingled blood clot, largely absorbed and replaced by a mass of rapidly proliferating spindle- and spider-shaped cells, of a decidedly fœtal type supported in a mucoid matrix. The tissue was not highly vascular, but the vessels present, for the greater part, were surrounded by an inflammatory infiltration in which eosinophilic leucocytes were notably frequent. Many of the fibroplastic cells, some of which were of very large size, contained considerable quantities of dark-brown pigment, presumably of hæmatogenous nature.

The mucosa of the appendix was intact, but the other walls were greatly thickened by a mingled growth of adult connective tissue, evidently of long standing, and by infiltrating sarcomatous cells of similar character to those noted in the external mass. In one area, these cells extended entirely to the mucosa, and the submucosa throughout was packed with them. The lymphoid tissue was for the greater part replaced by either these cells or by fibrils of connective tissue. In addition to the neoplastic elements, the smaller vessels were surrounded by inflammatory infiltration, acute or subacute in origin.

Occasional areas of necrosis were present, both in the appendix and in the external mass, and the possibility of a syphilitic process had not been overlooked. After a careful study, Dr. Brooks said he believed that the process was unquestionably sarcomatous, and that the probable primary lesion was in the wall of the appendix, where the malignant growth was perhaps excited by chronic and persistent inflammatory disease. He therefore classed the process as a fibrosarcoma of the vermiform appendix.

A search of the literature on primary sarcoma of the appendix showed a total of nine cases. In only five of these were there authentic pathological reports; three were of doubtful origin, and in one case the original report could not be found. The first case was reported in 1895.

This case was shown, Dr. Stewart said, because of the relative infrequency of the condition, and because it resembled so closely an ordinary attack of appendicitis. Indeed, the gross specimen, as well as the history, gave little hint of the true nature of the disease, and the case strongly emphasized the value of routine microscopical examination.

Dr. Eliot said that about three years ago he published a case of benign papilloma of the appendix, in which the growth completely filled the lumen of the organ. It must have existed for a number of years, but never gave rise to any symptoms

until three days before the appendix was removed. The patient had an apparently mild attack of appendicitis, and owing to the persistence of the tenderness, the removal of the appendix was advised. Upon operation, this papillomatous condition was found, the growth closely resembling a papilloma of the bladder.

CARCINOMA OF RECTUM.

DR. STEWART presented a man, 49 years old, who was born in England, and whose occupation was that of a carpenter. There was nothing important in his family or past history. About two years ago the patient began to suffer from diarrhœa having six or seven loose, watery, yellowish stools daily. After two or three months there was considerable blood and mucus present. He had no pain; only slight tenderness. His diarrhœa gradually increased in severity, and when he was admitted to the hospital he had as many as 24 movements a day; these stools were never formed, and their frequency and consistency was unaffected by diet. He had never vomited, but there was occasional retching; no hæmatemesis. Six months ago he had hemorrhoids, which disappeared under treatment. The abdomen had never been swollen. For the past eighteen months the patient had been losing flesh and strength, but had not stopped work.

Upon examination, about a finger's length from the anal orifice, there was a very tender, firm nodular mass, which had the feel of a much lacerated cervix uteri. An ounce or two of blood was expelled after each examination. The tip of the finger passed into the lumen narrowed by the growth, but not beyond. The patient complained of no pain in the rectum, but had a vague tenderness referred to the lower abdomen. At times, there was slight difficulty in starting micturition, but no urgency, frequency, tenesmus, dysuria nor hæmaturia. His appetite was good, and he slept well.

Operation March 25, 1908: Upon opening the abdomen by the Pfanensteil method, examination of the pelvic contents showed that the rectum was involved up to the pelvic brim; this included the entire rectum and the lower part of the sigmoid. The meso-cæcum was opened, and the superior hemorrhoidal vessels tied. Following this, both internal iliac vessels were easily ligated. The bowel was then cut in two and clamped, the cautery being used, and a ligature placed on the upper portion. The lower end

was carefully turned in, as it was decided not to attempt to remove the diseased bowel. An inguinal artificial anus, made by splitting the muscular fibres, was then established about an inch and a half from the anterior superior spine, the bowel being well drawn through. (The ligature was left *in situ*, and remained there for three days before its removal; some leakage occurred, however, before the first dressing.) The abdominal wound was then closed.

As the patient was in good condition, it was deemed permissible to attempt removal of the diseased rectum. Accordingly, the patient was placed in the Sim's position, and an incision made beginning down by the side of the coccyx and running forward along the median line to and around the anus, the anal opening having been carefully sutured. This incision was deepened, and to gain additional room the coccyx was removed. Through this incision it was possible, after opening the peritoneum, to reach up and secure the upper end of the lower portion of the bowel. This was turned down, and carefully cut away from the bladder wall, the whole being removed. The perineum was closed by sutures, leaving a large drain and gauze packing. No attempt was made to close the pelvic peritoneum, as this would have been impossible from the perineal wound. In the early part of the operation, during ligation of the iliacs, the ureters were isolated, and subsequently they were dissected well down to the bladder: it was therefore possible, in the part of the operation performed from below, to avoid them easily. At no time was there any hemorrhage, nor was it necessary to secure a single artery. In dissecting the tumor from the posterior bladder wall at the site of the trigone, as the seminal vesicles were involved, it was necessary to place a sound in the bladder to avoid wounding the wall of that organ in this location.

The tumor, upon removal, measured eleven and a half inches. It was examined in the pathological department by Dr. Charles Norris, who classified it as an adenocarcinoma. Since operation, the patient has gained 20 pounds. His abdominal wound healed *per primam*. The perineal wound healed more slowly, but it had for some time been entirely closed. Control of the artificial anus was almost perfect; on some days he had but one movement; on others, particularly if the bowels were loose, he might have two. He stated that his sensations gave him no indication as to whether or not his bowels had or were about to move. Ordinarily, if he

attended to this in the early part of the day, he went unsoiled until the next day. During the first dressings, before the abdominal wound was perfectly healed, in order to protect the wound from soiling, a large sheet of rubber dam was slit at its centre, and this was drawn over the protruding cuff of the bowel, which it fitted snugly. Afterwards, dressings were placed around the opening of the bowel and the rubber folded over from all directions, thus protecting the abdominal wound much more thoroughly and effectively than could be done by the use of Paul's tube and a rubber tube leading away from the bed, or by any other method that could be thought of. Indeed, the attempt to introduce any sort of a tube for the purpose of conducting away the fecal contents was usually unsuccessful, because it was impossible to tie such a tube into the bowel for any length of time without producing sloughing of the bowel wall.

This case was placed on record, Dr. Stewart said, (1) because it was believed that the choice between an inguinal artificial anus and one placed according to the Kraske method, or some modification thereof, was still an open question which could only be decided from the records of a large number of cases; (2) to call attention to the easy control of hemorrhage by resorting to ligature of the internal iliac artery.

TRAUMATIC APHASIA FROM CONTRE COUP.

Dr. Howard Lilienthal presented a man, 38 years old, a native of Russia and a painter by occupation, who was admitted to Mt. Sinai Hospital on November 5, 1907. The history obtained then was that about two months prior to admission he had received an injury of the right side of the head, with fracture of the skull: that he had remained senseless for two weeks after this injury and that upon regaining consciousness, he was completely aphasic. This, with the exception of pain in the head over the region of the injury, and some weakness in the right arm and leg, was practically his only symptom. There was no history of convulsions; no paralysis; no difficulty in swallowing. There was no depression over the site of the original fracture, which had been operated on at the Eastern District Hospital. It was ascertained that prior to his injury he could read, write and spell fairly well, and had been intelligent enough to carry on his business as a boss painter, making out his own accounts,

etc. The only word he could now speak was the German word "alles," and this was his invariable reply to all questions put to him, although he understood them perfectly. For example, when a key was handed to him he would call it "alles," but he was able to draw a picture of a key and indicate its use.

The patient was examined from a neurological standpoint by Drs. Sachs and Abrahamson. Dr. Elsberg, Adjunct Surgeon, also spent much time in careful observations of the case. A diagnosis of probable hemorrhagic cyst was made, located over the left Rolandic area, and due to *contre coup*. The aphasia pointed to a lesion of the Broca convolution, and craniotomy in that region was advised. The operation was done by Dr. Lilienthal on November 8, 1907. Upon opening the skull over the left Rolandic fissure, the pia was found to be very adherent to the brain. Upon incising the dura, a small quantity of serous fluid escaped; some of this was collected for examination, and was reported as degenerated brain tissue. The lesion found was regarded as a broken down cyst.

There was no improvement in the man's speech subsequent to the operation. Since then, systematic efforts had been made to teach him to regain his lost power of speech, beginning with rudimentary methods, but instead of teaching him German, which was his natural language and in which he was most proficient, the instruction was entirely limited to English words, with the idea of demonstrating, if possible, the correctness of the physiological theory that when the word-centre was destroyed, as it apparently had been in this case, the adjacent brain cells, or perhaps the corresponding centre on the opposite side of the brain, would take up the work. The patient was now able to speak English fairly well. He understood German,—as he did before the operation—but with the exception of the one word, "alles," he was unable to speak in that language.

Dr. Charles A. Elsberg, who has seen the patient both before and after the operation, said he had been very much interested in watching the order in which the speech and reading power had returned in this case. In learning the alphabet, he was first able to recognize and pronounce certain consonants, such as "p" and "b." Then came "t" and then "s," and after that he learned the vowels and the other letters of the alphabet. It was quite some time before he was able to read words, and at

first only very simple words. In the beginning he was often unable to pronounce the word. He often could pronounce parts of a word, but not the entire word.

DR. I. ABRAHAMSON, who had studied the case in Dr. Sach's ward at Mt. Sinai Hospital, said the patient had recently had several attacks of Jacksonian epilepsy beginning in the right face, and in each instance these were followed by a temporary loss of his newly regained power of speech. The case was apparently one of cortical motor aphasia with a distinct focal lesion of Broca's area due to a trauma on the opposite side of the skull, resulting in practically complete motor aphasia and a slight degree of faciobrachial monoplegia. The temporary retrocession of speech occurring after the attacks of Jacksonian epilepsy, involving the right face, apparently disproved the theory that the impaired function of the left word-centre had been taken up by the opposite side of the brain. In connection with his remarks, Dr. Abrahamson gave a schematic representation which explained in detail the various components of the aphasia in this case.

SUPPURATING HYDATID LIVER CYST COMPLICATING CHOLELITHIASIS.

DR. LILIENTHAL presented a man, 33 years old, who since childhood had suffered from attacks of biliary colic, never, however, associated with jaundice. He came under Dr. Lilienthal's observation in November, 1907, and was operated on at the Mt. Sinai Hospital on November 25th for what was thought to be a cholelithiasis, as a hard mass was felt prior to operation in the region of the gall-bladder. Upon opening the abdomen, a pericholecystic mass was found, with a single large stone in the gall-bladder. The stone was removed, and the hard mass was incised: it was found to contain pus, which was evacuated through the gall-bladder. The patient's wound failed to heal, and several weeks after the operation a small hydatid cyst was evacuated through the sinus, which continued to drain freely for about two months, enormous quantities of fluid and numerous small and large cysts escaping. Two ribs were then resected posteriorly, and a counter-opening made on a probe pushed down to the point. This exposed a large hydatid cyst containing calcified plates, showing that it must have been there for a long time. Two handfuls of these plates were avulsed, and then a tube was run through

from front to back. This second operation was done on March 4, 1908, and the patient left the hospital about a fortnight later. He was now practically well, although there was still a slight discharge from the wound.*

In reply to a question, Dr. Lilienthal said the pleura in this case was simply pushed upwards—not opened.

Dr. George E. Brewer said that in one case of hydatid cyst which he was unable to remove or completely empty excepting through long-continued drainage, he brought about death of the daughter cysts by injections of silver nitrate solution, beginning with a strength of 1–8000 and gradually increasing it to 1–500. This practically sterilized the cyst.

ŒSOPHAGEAL DIVERTICULUM.

Dr. George E. Brewer presented a woman, aged 78 years, who was admitted to the Roosevelt Hospital in March, 1908, suffering from difficulty in swallowing, with progressive loss of weight and strength. The history of her trouble dated back some nine years, at which time she began to have difficulty in swallowing large particles of food. This condition gradually became more marked, so that she was obliged to masticate with greater care, and to exclude from her diet many articles of food which were formerly swallowed with ease. About two years ago she began to experience difficulty in swallowing fluids. In attempting to swallow rapidly, there would occur a spasmodic closure of the pharynx, with regurgitation and coughing. She was obliged to swallow only a very small amount of fluid at a time, and several efforts would be required to accomplish the result. About this time she noticed occasional regurgitation of a mouthful of glairy mucus. During the past six months, the patient has been unable to swallow any solid or semi-solid food, and has had increasing difficulty in swallowing fluids. She has lost between 20 and 30 pounds in weight, and the efforts in swallowing are almost invariably accompanied by pain and vomiting. On examination, nothing unusual could be determined by inspection of the neck or pharynx. On attempting to pass an œsophageal bougie, it was arrested at a point eleven inches from the incisor teeth. After a number of attempts, a small bougie

* Note.—At present writing, May 26, wounds are soundly healed.

(about 20 mm. in circumference) was passed along the right wall of the pharynx, below the obstruction into the stomach. This was followed by several larger sizes, which would pass into the stomach if the point was slightly bent and kept closely in contact with the right lateral wall. On attempting to swallow a glass of water, the patient would bend the head well to the right side and would make several distinct attempts before a drachm of the fluid would pass into the stomach, and it would require about fifteen minutes effort to succeed in swallowing four ounces of water or milk.

Several X-ray examinations were made after the patient had swallowed a quantity of bismuth paste. These were not particularly satisfactory but demonstrated the presence of a pouch apparently situated to the left of the œsophagus, opposite the upper border of the cricoid cartilage. As the patient presented evidences of marked weakness on account of the long-continued absence of nourishing food, and as there was well-marked evidence of arterial sclerosis and chronic nephritis, the danger of any operative procedures was fully discussed with her and her family. As her condition was distressing in the extreme, and as there was little or no likelihood of improvement without operation, she decided upon radical surgical treatment.

Under scopolamine, morphine and ether anæsthesia (the rectal method), an incision was made along the anterior border of the sternomastoid muscle from the greater cornu of the hyoid bone to a point well below the cricoid. The various tissues were then separated and retracted until the lateral wall of the œsophagus was exposed. It was found that about the junction of the pharnyx and œsophagus there was an oval protrusion about the size of a robin's egg which could be made to descend along the lateral wall of the œsophagus by the introduction of a bougie from the mouth. An opening was made through the centre of this pouch, and the finger introduced into the œsophagus. On attempting to pass the finger downward, a marked narrowing of the tube was noted about on a level with the lower border of the diverticulum. On retracting the edges of the diverticulum wound, this stricture seemed to be made up of a thin fibrous ring which gave the appearance of a symmetrical narrowing, such as would be produced by the tying of a string tightly about the tube. This ring was divided into two parts and thoroughly dilated with the index finger, after which the diverticulum was removed by

an elliptical incision, and the œsophageal wound closed by two layers of sutures. As the wound had been greatly contaminated by secretion from the pharynx, its upper two-thirds were closed by layer suture, and a cigarette drain left in the lower angle. Practically no reaction followed the operation, although the wound was moderately infected from the first. Nothing was swallowed for five days, although she received an abundance of salt solution and peptonized milk by the rectum. On the fifth day she was given a little sterile water to swallow, and the next day she took a quantity of milk, and the rectal feeding was discontinued. During the second week she was able to take custard, junket, cereals and soft puddings, and before she left the hospital she swallowed with ease beef steak, roast beef and potatoes, and in fact any kind of solid food. At no time was there any leak from the œsophageal wound. At present she is able to swallow all kinds of food and experience no discomfort whatever.

SUPPURATIVE TENOSYNOVITIS OF FLEXORS OF HAND AND WRIST. BIER'S HYPERÆMIA: MULTIPLE INCISIONS.

Dr. Charles H. Peck presented a woman, aged 40, who had pierced the pulp of the right thumb with a cod-fish bone four days before her admission to the French Hospital on April 20, 1908. No attention was paid to the wound until that night, when there was severe throbbing pain in the thumb, with slight swelling. The pain, swelling and extension of the inflammation up the arm continued, in spite of a small incision which was made by her physician, and when admitted to the hospital there was tenderness and swelling along the flexor aspect of thumb, and over the great palmar bursa at the wrist. Temperature on admission was 101.2; pulse, 136. No enlarged axillary glands. The leucocyte count on April 22nd was 57,000. Under ether, the incision in the ball of the thumb was enlarged, and an incision over the flexor aspect of wrist was carried directly into the great palmar bursa. Little pus was obtained; cultures showed growths of both streptococcus and staphylococcus aureus. The wound at the wrist was packed. On April 22nd, two days later, an incision was made on the flexor aspect of the forearm, upper third, and packed with gauze.

The Bier's constriction was applied for the first time, two hours in the morning and two hours in the afternoon. The tem-

perature was 102. The next day the bandage was applied eight hours in the 24, and on April 24th, 18 hours in the 24. The wounds were suppurating more freely; the packing had been omitted altogether; the fingers were moved each day at the dressings, and the pus gently pressed out of the incisons. The leucocytes were 38,500; temperature, 101. From this time until April 29th, when the temperature reached normal, and the leucocytes were down to 21,500, the constricting bandage was left on the arm from 14 to 20 hours out of the 24. The suppuration extended down the little finger tendon, and incisions were made under cocaine along its course on April 26th. On April 27th another incision was made under cocaine on the flexor aspect of forearm, middle third, and pus evacuated from the deep muscular planes; also an incision in the thenar eminence down to the flexor tendon of the thumb.

Altogether, eight short incisions were made from April 20th to April 27th. No packing was used after the first three days: The constricting bandage was applied, as described, from April 22nd to May 1st, nine days in all. Wet dressings of weak bichloride solution were kept on constantly, and the wounds were dressed daily with gentle pressing out of the pus, and passive motion of the fingers. Suppuration had practically ceased by May 1st, eleven days after the first incisions, and nine days after the first application of the bandage; the temperature remained normal after April 29th. There was no tendon sloughing, and the patient is rapidly regaining motion in both fingers and wrist. Healing is complete, excepting for two small granulating areas on the forearm, and one on the ball of the thumb.

Dr. Willy Meyer said the case shown by Dr. Peck proved the correctness of Bier's statement that gauze packing of the involved tendon sheaths was apt to be followed by necrosis. Bier contended that the same thing occurred in acute bone inflammation and periosteitis and osteomyelitis. Dr. Meyer thought it was unnecessary to apply the Bier hyperæmic treatment in a case of subcutaneous phlegmon, unless, perhaps, from a cosmetic standpoint; free incisions and drainage usually sufficed. But when it came to the preservation of function, and especially in such an acute case as the one shown by Dr. Peck, then Bier's hyperæmic treatment was indicated, no matter how much time or trouble it involved. The incisions in these cases were made to overcome

suppuration; the hyperæmic treatment to overcome inflammation. As long as tenderness and temperature persisted, we could feel assured that pus was still somewhere and this should be evacuated. Some time after the wound had closed, the hot air treatment would be found beneficial to overcome stiffness and œdema.

SARCOMA OF THE OVARY IN A CHILD.

DR. JOHN F. ERDMANN presented a girl of thirteen and a half years, who came under his observation in August, 1907, with the diagnosis of a probable appendicitis. She complained of pain in the abdomen, and had a temperature of about 100. A large, painful, movable mass could be felt in the abdomen, extending well up above the umbilicus. Prior to the operation, which was done on August 5, 1907, Dr. Erdmann said he regarded the tumor as a cyst. On opening the abdomen, he found a large, pultaceous mass springing from the left ovary, with the pedicle twisted, and associated with it was a mass of the omentum. The growth showed all the evidences of strangulation; during the removal the sac ruptured. The peritoneal cavity was cleaned as thoroughly as possible. At the time he found implantation secondary growths. Dr. Harlow Brooks reported as follows:

"Free hand sections of the large ovarian growth show the body of the growth to be well localized by a relatively thick membrane of newly formed connective tissue, derived apparently from the ovary, although this membrane has been infiltrated by the new-growth cells which in part enter into the make-up of it. Still, it seems to me that the malignant characteristics do not extend through this sheet. The central portions of the tumor, notably the grayish-white semimucoid material, proves to be made up of a stroma of connective tissue, into the make-up of which embryonic cells largely enter. These cells merge into other cells which are mostly found in semi-acinar arrangement, and which appear to be epitheloid in nature. The blood vessels are not very numerous, but many of them are made up of walls, into the make-up of which the neoplastic cells enter. A diffuse hyaline or mucoid degeneration seems to have involved both epitheloid and connective-tissue structures, and in some places the growth closely resembles a myxoma. The growth is histologically sarcomatous, but like many similar growths of the ovary, especially in the young, epitheloid elements, though of course embryologically entodermal or mesodermal, enter largely. I am inclined to consider the growth a sarcoma, although of a rather low grade of malignancy, and it may not return if it was possible to remove it entirely. In fact, it seems to me that these early sarcomata of the ovary are clinically more like teratoma than sarcoma such as we meet in other parts of the

body. Of course, if local or vascular infection has already taken place, the prognosis cannot be otherwise than bad."

The patient left the hospital within a fortnight after the operation, and when she returned, a few days ago, she had a tumor, almost the size of a fœtal head, springing from the scar of the operation; the tumor was firmly fixed, and apparently involved the uterus, peritoneum and abdominal wall.

TWO PERFORATIONS OF A GASTRIC ULCER WITHIN SIX MONTHS.

Dr. George E. Brewer presented a man, aged 21, who was admitted to the Roosevelt Hospital in October, 1907, suffering from acute pain in the epigastrium, vomiting, and great prostration. There had been a previous history of gastric ulcer for two and a half years. The present attack occurred on the morning of his admission. On examination, there was moderate tenderness of the abdomen, and board-like rigidity over the upper right quadrant; the point of greatest tenderness seemed to be in the region of the pylorus. There was moderate elevation of temperature and pulse. The patient seemed greatly prostrated. He was immediately prepared for operation. On opening the abdomen, a quantity of free fluid escaped. On examining the stomach, an extensive induration was found at the pylorus, in the centre of which a perforation had occurred which allowed the free escape of gas and gastric contents. There was a moderate amount of adhesive peritonitis in the neighborhood, and a quantity of turbid fluid seemed everywhere present in the peritoneal cavity. The perforation was closed by a purse-string suture of silk, and the peritoneal cavity washed out with a large amount of normal saline solution. The wound was closed without drainage, and the patient made an uninterrupted recovery. When he was discharged from the hospital, he was able to eat solid food with little or no discomfort.

Four weeks ago the patient was again admitted to the hospital, suffering from acute epigastric pain and tenderness. He stated that for the past month he had had more or less pain after eating, with sour eructations and occasional vomiting. On examination, the upper half of the right rectus was rigid, there

was moderate rigidity of the upper half of the left rectus, with marked tenderness over the entire epigastric area. Temperature, 100; pulse, 84, and of good quality. He was immediately prepared for operation, and at 9 A.M., just four hours after his first symptom, the abdomen was re-opened and another perforation found almost in the same position as the original one. This was closed by a purse-string suture, and as the induration at the pylorus seemed greater than at the first operation, and as the patient was in exceedingly good condition, a gastro-enterostomy was performed by the no-loop suture method. The upper abdomen was irrigated with normal salt solution, although there was little or no evidence of foreign material in the peritoneal cavity. The wound was closed without drainage. No reaction followed the operation, and he made an uninterrupted recovery.

BACKWARD DISLOCATION OF THE ELBOW; ULNAR PARALYSIS.

DR. F. KAMMERER presented a young woman who had come under his care in August, 1907, suffering from a backward dislocation of both bones of the forearm, of three weeks' standing. All attempts at reduction under anæsthesia failed. A longitudinal incision was thereupon made over the posterior surface of the elbow-joint, exposing the latter freely. Reduction was then accomplished with some difficulty, although during the necessary manipulations to effect the same, the cause which had prevented prior reduction was not ascertained. The extreme tip of the coronoid process had been torn away. Re-dislocation of the forearm frequently occurred during further manipulation. The wound was entirely closed, and after several days, when primary union seemed assured, a plaster-of-Paris dressing was applied with the arm flexed at a right angle. The joint-surfaces were in normal position at the time.

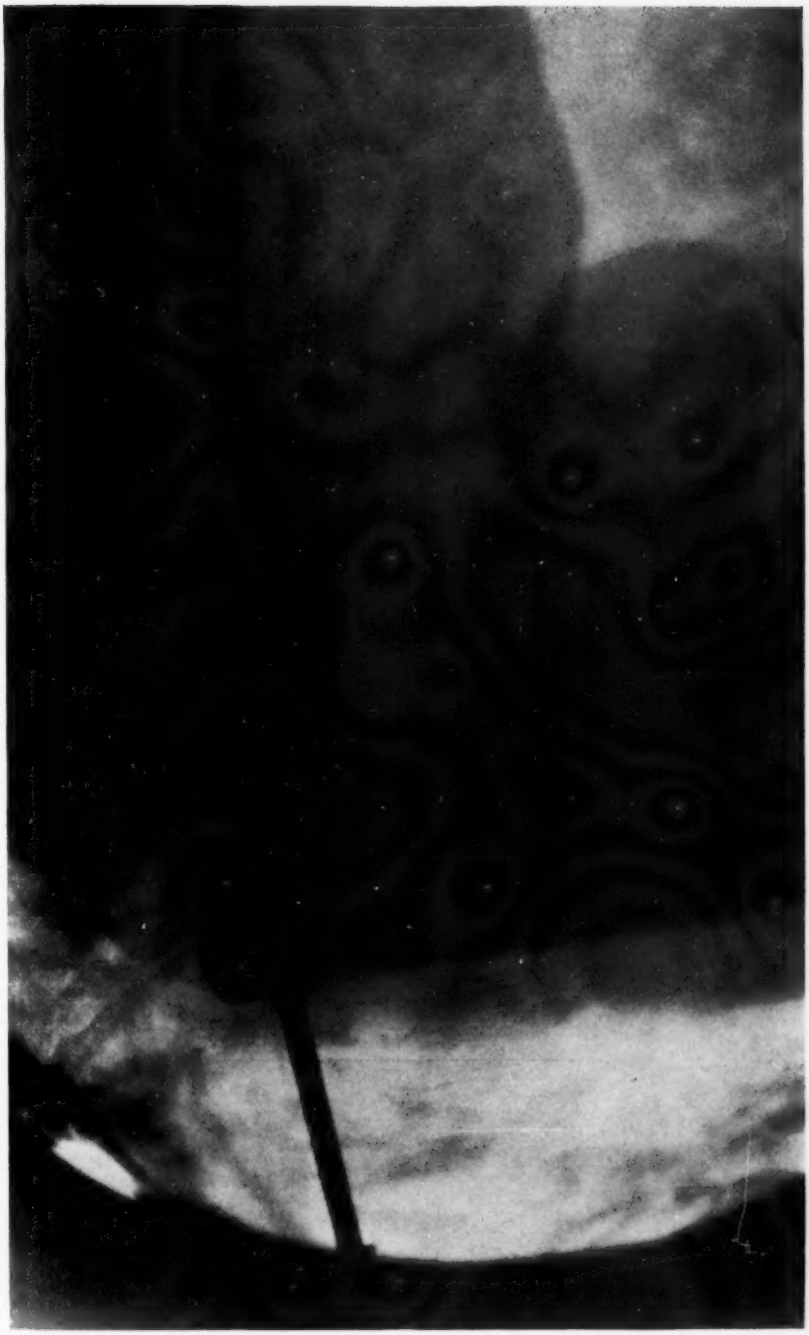
On the day after operation a paralysis of the ulnar nerve, not complete, was noticed, which rapidly grew worse and in a few days the typical picture of complete loss of motor and sensory function of the nerve developed. Upon removal of the plaster-of-Paris dressing, three weeks later, it having become somewhat loose, it was seen that both bones of the forearm were again dislocated backwards. The joint was again opened in the old

cicatrix, the bones forced back to their normal position and a long nail was driven through the olecranon into the humerus, with the arm again bent at a right angle at the elbow (see X-ray picture, Fig. 1.) A plaster-of-Paris dressing was again applied for four weeks, from which the head of the nail protruded. The latter was pulled out at the end of the second week. Meanwhile, the muscles supplied by the ulnar nerve atrophied, and the hand assumed the well-known *main en griffe* position. After removal of the dressing, the bones were found in their normal relation to one another, and active and passive movements were begun. About five months after the injury, the ulnar paralysis having shown no improvement, an incision, about six inches long, was made over the nerve, and the latter exposed in the entire length of the incision. Special care was taken to follow it along its course through the flexor carpi ulnaris muscle. At no point was a lesion of the nerve detected, and nowhere did it appear atrophied. The incision was closed. A few days after this operation sensation began to return, and in a few weeks the atrophied and paralyzed muscles began to resume their function. This operation was done on January 11, 1908, and at present the sensory and motor symptoms have almost entirely disappeared. The forearm can be flexed beyond a right angle, and extension is possible almost to the full extent; pronation and supination were somewhat limited.

Dr. Kammerer said he was unable to account for the lesion of the ulnar nerve. He naturally thought some injury had been done during exposure of the joint and the dissection of the soft parts from the internal condyle of the humerus, but this was disproved by the dissection of the nerve later on. The necessary lesions of the joint surfaces by the nail had evidently not in the least interfered with the further function of the elbow-joint.

Dr. Eliot said he had had a case similar to the one shown by Dr. Kammerer, with ulnar paralysis, which was relieved by exposure of the nerve and resection of the internal condyle. In another case of paralysis after fracture of the neck of the radius, almost immediate improvement followed the removal of callus which pressed against the posterior interosseous nerve. In that instance the improvement was just as striking as in the case of Dr. Kammerer's.

FIG. 1.



Skiagraph showing fixation by nail of ulna to humerus to overcome persistent tendency to backward dislocation.

CHYLE CYSTS OF THE MESENTERY.

Dr. William B. Brinsmade read a paper with this title for which see page 565.

In connection with his paper, Dr. Brinsmade showed a patient illustrating the condition described.

Dr. Charles N. Dowd said that a few years ago he had presented to the society a case which suggested several points about the formation of mesenteric cysts. The cyst, which closely resembled an ovarian multilocular cyst, had no epithelium in the wall of the largest chamber while in the smaller chambers there were distinct epithelial linings. The absence of an epithelial lining therefore did not at all mean that there had never been such a lining—just as in parovarian cysts the small ones have epithelial lined walls and the large ones have lost their epithelium through pressure—so in mesenteric cysts the epithelium has often disappeared. In the cyst which he had presented the content of the different chambers too had been different, some containing blood, others clear fluid. This cyst was manifestly of embryonic origin; from an ovarian rest; and there were many reasons for believing that most of the mesenteric cysts were also of embryonic origin, the content of the cyst depending in a measure on its location. If it was located among the lacteals it was easy to believe that chyle might exude through the wall of a compressed vessel and find its way into the cyst cavity, in fact it was much easier to believe this than that a cyst should result from the simple occlusion of a lacteal vessel. One hardly understands why the occlusion of a lacteal should result in a chyle cyst any more than the occlusion of a leg vein should result in a blood cyst. The anastomosis is too abundant and the internal pressure too slight to make such formation easy.

Ducasset had reported a case in which some loculi contained yellow serous fluid with no evidence of chyle and others contained white chylous fluid. Demon had also reported a multilocular cyst in which one chamber contained blood and the others chylous liquid. Küster described a chylous cyst which was lined with epithelium and Pagenstecher one in the fluid of which degenerated flat epithelial cells were found.

We may be misled by the statistics of recoveries from the simple drainage of these cysts. The later histories were not given

and we do not know how many of them refilled. We do know, however, that many of the ordinary cysts, which are simply drained, refill at a later time. Hence in dealing with these cysts it seems wise to remove at least some of them.

SUPRAPUBIC PROSTATECTOMY.

DR. JOHN F. ERDMANN showed eight specimens of exceptionally enlarged prostates which he had removed during the past few weeks. In all of these cases the operation has been done by the suprapubic route, which the speaker said he now favored in practically all cases, in preference to the perineal.

REAMPUTATION OF LOWER END OF LEG FOR EXOSTOSIS IN A PREVIOUS BIER AMPUTATION.

DR. JOHN F. ERDMANN presented a specimen of reamputation of the leg at the upper and middle thirds necessitated by an exostosis between the end of the tibia and the Bier flap. This occurred in a man 41 years of age, whose leg had been amputated by the Bier method in one of the New York hospitals subsequent to a trauma. Some few months after the amputation the patient observed that the skin over the end of the stump was becoming taut and ulcerated. He was seen by Dr. Erdmann, who advised reamputation, owing to the fact that the stump was decidedly conical and the skin covering it drawn very tightly, while at the apex an ulcer the size of a half-dollar existed. Upon dissection of the stump by Dr. Erdmann it was found that the thin Bier flap had been pushed three-quarters of an inch away from the tibial end by the filling in with ossific or calcareous tissue.

Dr. Erdmann stated in showing this specimen that he presented it with a view of showing one of the dangers of the Bier flap.

DR. WIILY MEYER, in discussing the last specimen shown by Dr. Erdmann, said the patient referred to had been under his care for almost two years. The original injury to the leg was sustained in a railroad accident, with far-reaching blood invasion between the muscles, etc. Amputation became necessary and he did the osteoplast method. The periosteum of the tibia was also much suffused with blood. A partial necrosis of the bone-flap followed, but the wound healed at last. The patient was very restless and put the artificial leg on too early, so that there was now and then superficial soreness. He had intended to transplant a skin flap from the other leg in order, according to X-ray pictures, to preserve the bone-plasty, which had proved a success.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting Held May 4, 1908.

Dr. G. G. Davis, in the Chair.

HÆMOPHILIA TREATED BY TRANSFUSION.

Dr. Francis O. Allen related the history of a boy of twelve, who was admitted to the Presbyterian Hospital a year ago, with a history of having bled from the mouth for four days previously. The bleeding had been profuse.

On admission, the patient was comatose, very pale, the skin was flabby and waxy, and a thin stream of blood was oozing from the mouth.

He was treated for two days with various drugs and with saline solution subcutaneously. The oozing continued, and the boy became weaker and more deeply unconscious. The hæmoglobin on the day of admission would not register on a Hare hæmoglobinometer, which does not register below ten. The resident physician estimated it as four. The next day it was estimated as five. The blood from the mouth tinged the pillow-case a pale yellow.

The second day after admission, Dr. Stryker, in whose care the boy was, asked Dr. Allen to transfuse the child. This was accomplished after much trouble, an uncle of the child consenting to be the donor. The technic was bad, owing to a lack of the proper instruments. The boy must have received only a small amount of blood, but how much it was impossible to state. During the operation, his mental condition changed, becoming bright enough for him to complain of pain and call the doctor hard names.

Two days after the operation, the hæmoglobin had risen from five to fourteen, and the red cells from 1,060,000 to 1,240,000. The bleeding stopped after the transfusion, but recurred slightly at intervals for the next five or six weeks. The hæmoglobin contiued to increase.

On the 4th of June, one month after admission, the hæmoglobin registered sixty-eight, and the red cells 3,930,000. The boy was discharged in good condition the only thing observable being that the teeth were carious and very irregular. It was almost impossible to tell where the bleeding came from; at times it seemed to come out of the teeth themselves, two of which were mere shells; at other times, it seemed to come from the edge of the gums.

The boy has been back to the hospital three or four times since. During the past winter he was admitted with hæmoglobin registering fifteen. He was not transfused on this occasion, but treated medically. The hæmoglobin gradually rose. Two or three weeks ago he was in fair condition, although he had one swollen knee-joint, and there was a slight oozing from the gums on the least provocation.

HEMORRHAGE FROM THE BOWEL FOLLOWING APPENDECTOMY.

Dr. Chas. F. Mitchell related the history of a woman, aged twenty-six, who was admitted November 14, 1907, to the surgical ward of the Pennsylvania Hospital under the care of Dr. J. P. Hutchinson, with the following history:

Previous history negative: menses began when she was seventeen years of age, always regular, lasting four or five days, painful at times. No vaginal discharge. Has been married three years, and has had three children. Thinks she had a miscarriage about six weeks ago. Never was troubled with hemorrhoids or bleeding from the bowel, previous to admission.

Came to the hospital complaining that for the past six weeks she had almost constant bleeding from the vagina. When not bleeding there was a mucopurulent vaginal discharge present.

Physical Examination: Heart and lungs normal; slight tenderness noted in right lower quadrant of abdomen.

Vaginal Examination: Rather profuse vaginal discharge, not bloody. Cervix not dilated, uterus slightly movable. To the

right of the uterus, a firm rounded mass felt, apparently connected with, but not continuous with the uterus. Mass not tender.

Urine examination negative.

Diagnosis.—Right-sided salpingitis with adhesions.

November 19th, under ether narcosis, a median laparotomy was performed, the pelvic mass to the right of the uterus was found to be a hæmatosalpinx, which was tightly bound down by adhesions, the appendix being included in the mass. Left tube and ovary perfectly normal. After the adhesions were broken up, the mass which was made up of the right tube and ovary, was removed. The adherent appendix found to be very much inflamed, and was also removed, the stump of appendix first being crushed, and then turned in by means of a catgut purse-string suture.

Temperature immediately before and after operation was 98°, pulse 100. Patient did well until midnight, eleven hours after operation, when she became restless, complained of feeling faint, face became pallid, temperature dropped to 96.2°, and pulse became so weak and compressible that it could not be counted. There was no sweating. It was thought that a secondary hemorrhage had occurred, probably from the stump of the excised tube. The patient was again etherized, and the abdominal wound reopened, pelvis found to be perfectly dry, and no evidence noted anywhere of bleeding having taken place within the peritoneal cavity.

The stump of the appendix was then examined, but there was no sign of any bleeding at this region, the cæcum and colon being empty and collapsed. It was then noticed that the coils of small intestines about the umbilical region had a peculiar bluish color, were partially filled with fluid, which at the time was thought to be bloody in character. As the patient's condition was not good, no further exploration was made to locate the bleeding point or points, and before being removed from the operating table she was given intravenous injection of normal salt solution. Immediately after operation temperature was 97.2°, pulse 160.

November 20th, 5 A.M.: A little over four hours after the second operation, although still pale condition was fairly good. Temperature was 100.1, pulse 160, respirations 24. At 5 P.M. of the same day temperature was 98.4, pulse 124.

November 21st: Enema to-day brought away a large bloody stool, the blood being of a dark red color and mixed with fecal material. Later in the day passed three more stools, all of which contained blood.

November 22d: Had two stools to-day, both of which were made up principally of blood. Hæmoglobin 44 per cent., leucocytes 7250. Altogether there have been six bloody stools; unable to estimate exact amount of blood.

December 1, 1907: Eleventh day after operation, hæmoglobin 67 per cent.

December 6, 1907: Discharged from hospital to-day.

Dr. Mitchell added that during the last few years a number of cases of hemorrhage from the bowel following operations for appendicitis have been reported, the cause of this postoperative catastrophe being laid to some faulty technic of the operation. In a few of the reported cases the appendix stump was undoubtedly the site from which the bleeding came, as was proven either by secondary operation or post-mortem examination, but in the majority it was merely assumed that the bleeding came from the seat of operation.

He reported this single case to place on record a case in which the appendix was removed, the stump inverted by catgut purse-string suture, the operation being followed by severe hemorrhage from the bowel, which did not come from the inverted appendix, as was demonstrated by the secondary operation.

Dr. Wyeth[1] mentions in his paper on "Technic of Appendectomy," sixteen cases where the stump of the appendix was inverted, and which were followed by bleeding from the bowel, presumably from the stump of the appendix. In six of the sixteen cases was it clearly proven, by operation in five, and post-mortem examination in one, that the hemorrhage came from the stump of the inverted appendix. Thirteen of the sixteen cases recovered and three died.

Judd[2] reports an interesting case, which in many respects is similar to the case just reported. In his case the appendix was removed and the stump inverted by means of a silk purse-string suture. Eighteen hours after operation the patient complained of severe abdominal pain, and shortly afterwards passed by

[1] Journal American Medical Association, vol. xlix, pp. 121–1907.
[2] Journal American Medical Association, vol. xlix, pp. 1843–1907.

rectum about twenty ounces of bright red blood. During one hundred and forty-four hours succeeding the operation, passed fifty-eight ounces of blood. This patient was treated by morphine, quiet, no food, making an uninterrupted recovery, and was able to leave the hospital on the eighth day. In conclusion Dr. Judd says: "In this case the absence of any oozing from the stump was noted at the time of operation. It has always been my practice to clamp and tie with catgut any bleeding points before inverting the stump. In this case it seems incredible that such a hemorrhage should follow an operative procedure where the field was so dry, and in pondering over the subject it has occurred to me that some other explanation than bleeding from the stump is necessary to explain the cause."

I fully agree with Dr. Judd that it is most probable the hemorrhage in his case did not come from the appendix stump, but of course this fact was not proven. Its similarity to the case now reported suggests that the cause of the bleeding was the same in both cases.

It is a well established fact that bleeding from the stomach or bowels or from both, may follow any major operation. Busse [3] reports fourteen cases of his own, and eighty-two similar ones collected from the literature of the subject, in which bleeding occurred from the stomach or duodenum after abdominal operation. The mortality in this series of ninety-six cases was fifty-five per cent.

The pathological changes which take place after the various abdominal operations and give rise to the bleeding, either from the bowel or stomach, have not as yet been satisfactorily explained. A number of theories have been advanced, however, to explain this condition. Mr. Moynihan in his book on abdominal surgery, states that hæmatemesis may follow any abdominal operation, but is more especially to be looked for when the stomach, duodenum or bile-passages are the seat of disease. He mentions five theories as possible causes of hæmatemesis, which may hold good to explain bleeding from the bowel after operation, as well as from the stomach.

The five theories are as follows: (1) The anæsthetic; (2) distinct injury to the stomach or bowel, resulting in ulceration

[3] Archiv für klinische Chirurgie, 1905, p. 1568.

from which the blood comes; (3) (Von Eiselsberg) injury to the omentum, rough handling, twisting or ligating of the omentum, producing a thrombosis of the omentum, which is followed by embolism in the walls of the stomach or bowel; (4) sepsis (Dr. W. L. Rodman's theory); (5) reflex nervous influence (Mayo Robson).

Mr. Moynihan personally believes that Dr. Rodman's theory of sepsis is the correct one, and in support of this theory says: "This seems to me the most likely of all the explanations that have been given, though it cannot be denied that in some instances the obvious evidence of sepsis is wanting. In some of these cases it may be that the sepsis is of such a character as to produce a rapidly fatal toxæmia, the poison acting so rapidly indeed that local evidences, peritonitis, etc., have no time to develop.

Of the five theories just mentioned, that of sepsis, as suggested by Dr. Rodman, seems to the reporter to be the most feasible. In a few cases the bleeding may come from pre-existing gastric or duodenal ulcers, but in only a few instances can the cause be laid to these pre-existing conditions.

Dr. Astley P. C. Ashhurst said that he had never felt convinced that the majority of the cases reported by Wyeth were really due to hemorrhage from the stump of the appendix; for it has been known for some time that the French pathologists, especially Dieulafoy, have called attention to the black vomit of appendicitis. It is probable that a good many surgeons have seen this black vomit without realizing what it was. The appearance of the appendix in cases of so-called hemorrhagic appendicitis is well known. In such cases, all that can be seen macroscopically in the submucosa of the appendix is a hemorrhage of some kind. The French hold that appendicitis is merely a local manifestation of a general disease. There may be ulcerations, various sorts of ecchymoses, and erosions in other parts of the intestinal tract that pass unnoticed; and hemorrhage may come from some of these. The view mentioned by Dr. Mitchell as supported by Dr. Rodman, which regards sepsis and toxæmia as the cause of these lesions, is that on which modern ideas of pathology are based. This view was elaborated by Gandy, one of Dieulafoy's pupils, who (in his Paris thesès, 1899) showed that in all gastro-intestinal ulcerations there is some form of toxæmia; and that in all forms of toxæmia there is gastro-intestinal ulceration.

Gandy traced in different diseases the various stages of the ulceration up to the well-formed ulcer, in which there may be either hemorrhage or perforation. Dr. Ashhurst therefore believes that it is the theory of sepsis and toxæmia upon which the pathology of this complication must be based. He has recently read in the Lancet an article by Hort, in which the claim is made that gastric ulcers and similar lesions are due to hæmorrhagins and mucolysins. The writer also claims to have been able to produce these lesions experimentally in some of the lower animals; and to have cured them with antivaccines and serums, both in the lower animals and in patients. This shows that toxæmia must be the cause of these lesions.

Dr. Jopson said that while Dr. Ashhurst's explanation of the theories as to the cause of hemorrhage after appendectomy would be plausible in cases of acute infection, they would scarcely explain cases that come on after interval-operations and within such a short time that sepsis would not have a chance to be an active feature. If one operates between attacks and the patient has hemorrhage from the bowel eight or ten hours after the operation, one is inclined to ascribe it to the operative technic. While Dr. Jopson agreed with Dr. Ashhurst that perhaps the majority of these cases are not due to hemorrhage from the seat of the appendix, he thought that a certain number must be. Studies in anatomy have shown the occasional presence of an abnormal vessel at the base of the appendix which might easily escape a purse-string ligature, unless most carefully applied. Although Dr. Jopson has continued to use this method of ligation with inversion of the crushed stump, he has been careful to pass the ligature under the site of such a potential vessel at the base of the meso-appendix, so that it could hardly escape the grasp of the suture. This he considers a point of great importance. If active hemorrhage is present, after one cuts the crushed appendix, one should throw a ligature about it. The ideal method is complete excision and the application of the through and through hæmostatic suture, such as is used in gastro-enterostomy, followed by another continuous Lembert suture. One could not, however, venture to recommend this procedure to a large class of surgeons who are doing satisfactory operations by other methods. Nevertheless, it is the ideal method, anatomically speaking.

Dr. Davis asked whether the appendix had been crushed first and then inverted with a single purse-string suture, and remarked that a blood-vessel might enter the appendix between the loops of the purse-string suture and so escape constriction. If no circular ligature were applied, part of the circumference would be without pressure. For this reason, in cases in which no circular ligature was applied, the technic might have had something to do with the production of hemorrhage.

GASTRO-INTESTINAL HEMORRHAGE FOLLOWING RADICAL OPERATION FOR HERNIA.

Dr. W. E. Lee, reported the case of a white male, who was referred to the Pennsylvania Hospital for radical treatment of two inguinal herniæ. As railway engineer, miner and prospector he had been accustomed for many years to severe physical work. During an illness of several months in his seventeenth year he had general anasarca but there was nothing else in his history which had any relation to his present hernial condition.

The examination showed an unusually well developed and well nourished man with heart, lungs and urine negative.

The right hernia appeared twenty years ago and had since been imperfectly supported with a truss. Seven years ago iodine injection treatment had been tried with negative results. At the time of admission there was an easily reducible scrotal mass about the size of a lemon.

The left hernia, which was of six years' duration and had been supported in a similar way with a truss, could just be felt at the left external ring.

Under ethyl chloride and ether anæsthesia the hernial sacks were ligated at the internal rings and excised, then the inguinal canals were reconstructed after Bassini's method.

During the following twenty-four hours he developed abdominal pain and slight distention, which were not relieved by free purgation, and toward evening he began vomiting a clear colorless fluid. The vomiting continued and the distention increased during the following day and fifty-four hours after operation he suddenly vomited 350 c.c. of dark fluid blood, after which the vomiting ceased. Twelve hours later and following a high alum enema he passed from the bowel 500 c.c. of blood very similar in appearance to that which had been vomited. There

was no more evidence of blood in the stools and his recovery was uneventful.

It seems safe to assume that this hemorrhage was in no way the direct result of any operative procedure for there was no handling of any part of the gastro-intestinal tract. Numerous similar cases of postoperative hemorrhage of obscure origin are on record, and although the majority of them have followed abdominal operations they occur after operations upon all parts of the body. Appearing usually during the first twenty-four hours, they may occur as late as the tenth day.

Various suggestions have been made as to the etiology. The fact that such hemorrhages are reported after operations with cocaine anæsthesia and even without any anæsthetic seems to discredit the anæsthetic being the cause. Trauma of the gastro-intestinal tract from the operative intervention is not to be considered in this case, for, except the gentle replacing of the coils of the small intestine as they appeared at the internal rings during the ligations of the sacks, there was no handling of the gastro-intestinal tract. Thrombosis of the arterial or venous systems with secondary embolism in the walls of the stomach and duodenum is suggested by the finding, post-mortem, of erosions and ulcerations in the organs. These lesions, however, are not constant and have only been found in a small number of the cases.

Sepsis, considered by Rodman to be the cause in a large number of cases, can also be eliminated in this instance, for there was no sign of any infection.

The prognosis seems to be very grave; in 96 cases collected by Busse there was a mortality of 55 per cent., while Purves reports 72.5 per cent.

The treatment is necessarily symptomatic. Morphia to quiet the movements of the gastro-intestinal tracts; gelatin by mouth or subcutaneously to increase the coagulability of the blood; and saline infusion to replace the lost blood have all proved useful.

TRAUMATIC CEREBRAL HEMORRHAGE.

Dr. Gwilym G. Davis reported the case of a woman, aged 34, who was brought into the Episcopal Hospital in an unconscious condition. It was ascertained that on the day of the

injury she had been on a visit to her sister and had drank freely and later started for home evidently under the influence of liquor. While on her way home she fell and struck her head on the pavement. She was taken to the police station and thence sent to the hospital. On admission her temperature was 99°, pulse 88, respiration 24. Patient was dull, heavy, stupid, almost in coma. She seemed to be sleeping soundly but could with difficulty be aroused. The mouth was open and tongue dry. There was some hemorrhage from the left ear and contusions of the nose, but no other apparent evidences of injury. There was a slight inequality of the pupils, the left being somewhat the larger. No paralysis of the extremities. Pulse full and strong; urine 1020; acid and slight trace of albumin; no sugar. Three days later she could be roused sufficiently to talk a little, but her mind was not clear. She fed herself with the left hand, but moved the right slightly. During the next ten days her mind became clearer, and her temperature normal and while much improved in her general condition the partial paralysis of the right arm persisted.

On the 14th day she was not so well and her temperature rose to 99.8°. The next day she was found almost comatose with a temperature of 100° and a full, strong pulse of 60 to the minute. The right pupil was dilated more than the left. She was immediately removed to the operating room and trephined on the left side below and in front of the parietal eminence. The dura bulged into the opening and looked congested, but showed no pulsation. On opening it no evidences of clot were discovered. She was turned on the other side and the trephine applied below and in front of the right parietal eminence. There was no pulsation, but on opening the dura a large clot was found. This was scooped and washed away, leaving the brain apparently normal. The dura was sutured, a wick drain inserted and both wounds closed. On the following day the drain was removed. Her temperature rose to 102° and her pulse to 132. On the 2d day after the operation she could be aroused and understood what was said. Her pulse improved and her temperature began to decline. On the 4th day her mental condition was improving, her temperature was nearly normal and she began to move her right arm. She continued steadily to improve and was discharged six weeks after the operation, cured. Her mind was clear and she had fully recovered the use of the right arm. This case was

not operated on earlier because of the lack of localizing symptoms at the time of her admission and her subsequent steady improvement. Previous to the day of operation the localizing symptoms were bleeding from the left ear on admission, a slightly larger pupil on the left side and two or three days later a partial paralysis of the right arm. These symptoms all pointed to a lesion on the left side of the brain. On the day of operation, however, the right pupil was the larger. In view, however, of the persistent right-sided paralysis and history of bleeding from the left ear it was decided to explore the left side first. The opening was so placed as to allow it to be extended forward if necessary and allowed of the areas of both the anterior and posterior branches of the middle meningeal artery to be reached. The paralysis as well as the absence of pulsation when the skull was opened showed that the left side of the brain was affected; whether it was by the direct concussion from the injury or by transmission of pressure from the right-sided effusion is a question. From the fact, however, of the paralysis not being noted until the 2nd or 3rd day after the injury we believe it to have been secondary and due to transmitted pressure. The fact of the clot being found on the right side shows that the dilated right pupil was a better index of the locality of the lesion than the partial paralysis of the right side. Traumatic cerebral hemorrhages whether epidural or subdural are most likely to occur at the site of impact. If, however, they are not found there then, as shown many years ago by Dr. Formad, they are found on the opposite side. While cerebral hemorrhages (clots) are very commonly the result of contrecoup cerebral fractures are rarely so and even when present are apt to be insignificant in extent. These hemorrhages by contrecoup are most likely to be subdural, although it is probable that in some rare instances they may be epidural or between the dura and the bone.

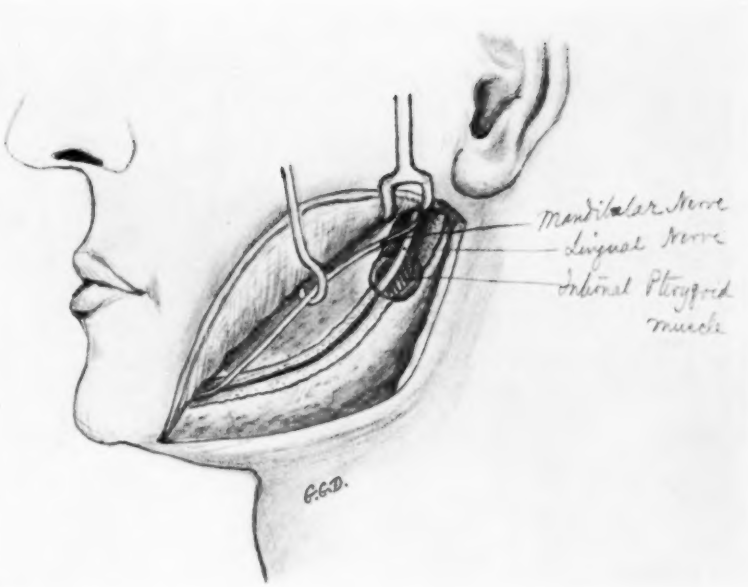
Dr. A. P. C. Ashhurst said that during the last few weeks he had seen, at the Episcopal Hospital, a case under Dr. Neilson's care, who was struck on the right side of the head during a fight, and was brought to the hospital in a semi-conscious condition. He was treated for fracture of the base of the skull. Dr. Ashhurst did not happen to see him again for several days, when he noticed that he was having twitching convulsions of the right forearm and both lower extremities; but the left arm

was not moving at all. The right pupil was widely dilated, and pressing upon the supra-orbital nerve elicited facial palsy on the left side, very marked. Dr. Ashhurst had thought that it was a case of extradural hemorrhage. The patient grew worse and died, and at autopsy a fracture of the skull involving the base and a subdural hemorrhage were found, as in Dr. Davis's case. The dilated pupil was on the side of the lesion, the right side, as also in Dr. Davis's case.

REMOVAL OF THE LINGUAL AND MANDIBULAR NERVES BY THE TWISTING METHOD OF THIERSCH.

Dr. Gwilym G. Davis reported the case of a woman, aged 47, who applied for the relief of a neuralgia affecting the tongue and lower jaw. The pains had begun five years previously, they were intermittent and affected chiefly the left side of the tongue and cheek down to the angle of the jaw. The paroxysms became frequent and severe, coming on most often in the morning when arising from bed. Sometimes, though rarely, she would have attacks at night. The pupils reacted normally and the tongue when protruded would deviate slightly to the right and was tremulous. She was otherwise well. The following operation was performed: An incision was made beginning about a centimetre below the ear and carried down behind the ramus and angle of the jaw and forward along the under side of its edge to just forward of the anterior edge of the masseter muscle. With a periosteal elevator the soft parts were detached from the bone and turned upward. The jaw was cleared off upward until the coronoid notch (incisura mandibulæ) was reached. A half inch trephine was then placed midway between the notch above and the lower edge of the jaw below and a button comprising the outer layer of compact tissue removed. The bridge of bone between the trephine opening and notch above was removed and the canal opened by means of a chisel downward until near the mental foramen. The mandibular nerve being thus exposed was lifted from its bed and displaced upward. (Fig. 1.) The bleeding from the accompanying artery was controlled either by ligation or packing. The trephine was then again introduced and another button of bone comprising the inner side was removed. With a forceps a considerable amount of fat was taken out and the lingual nerve exposed lying almost directly beneath on the internal

FIG. 1.



Operation for the removal of the lingual and mandibular nerves, by torsion.

pterygoid muscle. With a curved, long jawed, hæmostatic forceps introduced through the trephine opening both nerves were grasped, being lifted by a blunt hook until they were well up from the end of the forceps. The forceps were then slowly turned, not faster than one turn in a half minute or more. It took 13 minutes to complete the removal of the nerves.

The wound was packed with gauze and closed with sutures. The gauze was removed on the second day and the stitches on the fourth and the wound closed by primary healing. This mode of removing peripheral nerves by torsion very slowly applied was devised by Thiersch (Verhand. der Deutschen Gesellschaft für Chirurgie, 18th Congress, Berlin, 1889, p. 44).

Angerer (Archiv. für klinische Chirurgie, Bd. 53, s. 179) gave the results in 26 cases; of these 2 changed to some other branch, 7 returned and 17 remained free, 16 had been operated on for more than 4 years. Of these three were reoperated on and one died of intercurrent disease. Of the remaining 12, three had a return of the pain and seven remained free.

Dr. Davis further remarked that these results are so much better than those in which only small portions of the nerve are removed as to demonstrate its superiority and necessitate the abandonment of the latter. The Thiersch method can be successfully employed for the supra- and infra-orbital, the mandibular (inferior dental) and lingual nerves. It seemed to him to be decidedly preferable to the operations devised by Kocher, Horsley, Lücke, Pancoast, Minter, Carnochan, and many others. The lingual nerve if alone involved can be readily removed by the Thiersch method through an intrabuccal incision, but to attempt the removal of the mandibular (inferior dental) nerve through the mouth by the method of Paravicini is a delusion and a snare.

The disfigurement arising from an incision along the posterior and inferior edges of the jaw will be but slight if the subcutaneous tissues are first brought together with catgut sutures and then the skin united with the subcutaneous suture or very fine interrupted sutures removed by the 4th or 5th day. In the case reported the bone between the trephine opening and incisura above was removed in order that the mandibular nerve could be raised up out of the way in order to complete the section of the bone and allow access to the lingual nerve below.

The length of the lingual nerve removed was 15 cm. (6 in.)

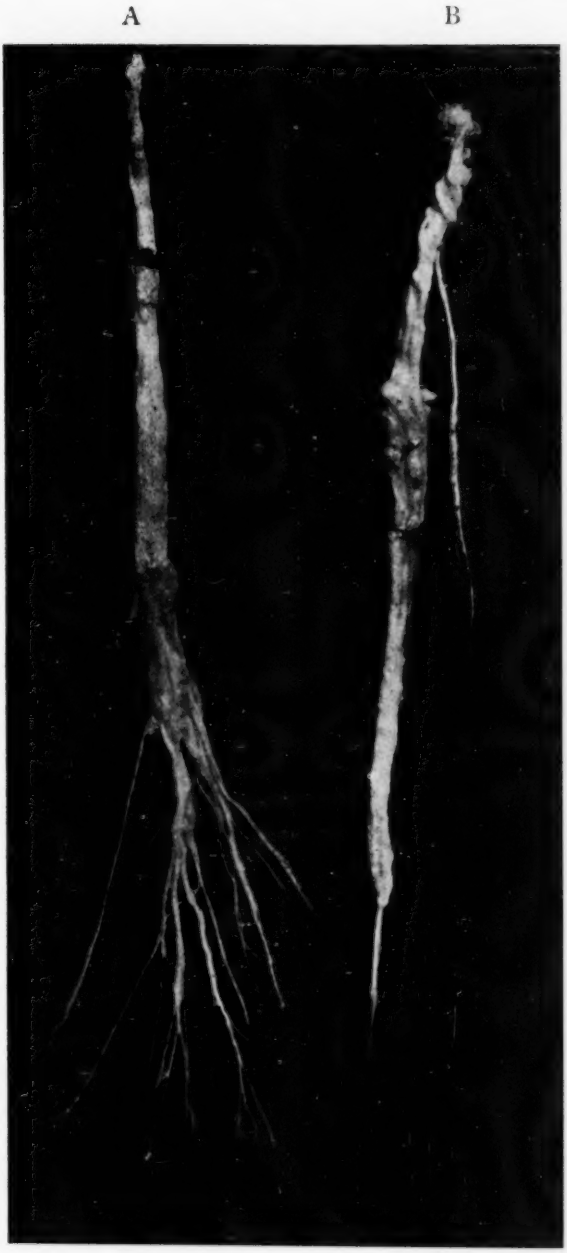
and that of the mandibular 12.5 cm. (5 in.) (Fig. 2.) Had the bone been removed and the dental canal opened clear down to the mental foramen as should have been done then more of the latter nerve could have been removed. The commencement of the incision from below the ear to the angle of the jaw is to be carried only through the skin and subcutaneous tissue; the parotid gland lies beneath and it should not be incised but dragged upward out of the way. There is a great tendency for the nerves to slip off the end of the forceps. To avoid this Dr. La Place suggested the use of a slender pair of long jawed curved hæmostatic forceps. Their use was found to be perfectly satisfactory in this case.

The area of anæsthesia produced by the operation embraced the left half of the tongue and the floor and outer wall of the mouth. The roof of the mouth, palate and upper alveolus were sensitive. Taste was lost on the left half of the tongue until its base was reached just in front of the circumvallate papillæ. On the outside of the face sensation was lost anteriorly in a line starting at the upper anterior edge of the pinna and passing downward and forward to the angle of the jaw; posteriorly the line extended from beneath the lobe of the ear, along the line of incision, to the middle of the chin. The patient is still free over a year since the operation.

Pathological Report.—A microscopical examination of the excised nerves by Dr. Geo. P. Müller revealed nothing except a slight proliferation of the neurilemma.

Dr. Morris Booth Miller recalled an experience that he had had about a year ago. In this case, Dr. Miller attempted to do an inferior dental nerve avulsion and at the same time he wished to avoid the disfiguring scar on the outside of the face. The method followed was first used by Paravicini, who suggested that the inferior dental nerve might be attacked through the mouth. Dr. Miller had a good deal of difficulty in performing the operation. The idea of avoiding any scar appealed to him, and he finally succeeded, but he had great trouble in reaching the nerve. He had thought that the spine of Spix and the internal lateral ligament would be landmarks more easily reached and identified than it proved. He caught a nerve and, after having pulled on it with a certain amount of force, he found that the tongue twisted with the twisting of the nerve. He therefore recognized that he had the lingual nerve, which was not involved.

FIG. 2.



A. Lingual nerve. B. Mandibular nerve. (Natural size.)

Fortunately, he had discovered his mistake in time to avoid damage. After a good deal of difficulty, he succeeded in getting out the proper nerve, but he would never undertake this method again. He considers the operation used by Dr. Davis the only correct one in reaching the inferior dental nerve, but the lingual can be reached more easily by the intrabuccal route. In working through the mouth, however, it is hard to get light and there is not much room for the finger or instruments.

Dr. Joseph M. Spellissy asked Dr. Miller whether there had been any return of the neuralgia in the case in which he had operated through the mouth.

Dr. Miller replied that the neuralgia partially returned some time after the operation.

Dr. George P. Müller said that he had done a number of these operations always removing the inferior dental nerve through an incision made along the angle of the lower jaw without having much of a scar, if the wound was closed by a subcuticular stitch. In two cases the incision divided the lower lobules of the parotid gland, and in one of these some trouble was experienced afterwards in closing a small salivary fistula. On one occasion he had removed almost as much of the nerve as in the specimen shown by Dr. Davis by trephining the angle and dividing the inferior dental nerve in the usual manner, and then, by means of a second incision, pulling it out of the jaw through the mental foramen and then twisting in the usual manner. The greatest difficulty he has encountered in these operations is to keep the nerve on the hæmostat while twisting. He uses a blunt hook to hold the nerve, keeping one hand on the hook, and the other twisting on the hæmostat. After having twisted the nerve three or four times and thereby loosening it, he allows it to untwist again and takes a more secure grasp with the hæmostat. The turns should be made very slowly.

Dr. Davis, closing, said that the operation is such a radical one so far as the amount of nerve that is removed is concerned and the fact that at least seven of the fourteen cases remained permanently cured makes it the procedure of choice when a peripheral operation is decided upon.

Regarding Dr. Miller's remarks in reference to the intrabuccal procedure, Dr. Davis said that the operation was that of Paravicini and was described in Bryant's "Operative Surgery."

The lingual nerve is very readily reached beneath the mucous membrane immediately behind the last molar tooth, where it crosses obliquely toward the tongue, but to reach the inferior dental by the intrabuccal method, however, is quite another question. It is very deep and close to the inner side of the jaw. Going upward and inward from the angle of the jaw, one meets the internal pterygoid muscle. Between this muscle and the jaw there is a chink in which the nerve and the artery are found; the muscle also is attached to the jaw with the spinamandibular ligament above it. The spine of Spix may not be perceptible to the sense of touch, for the finger will run along the jaw and over the spine to the ligament, which is in front of the nerve and the vessel. To reach these, one must get rid of the ligament. If it is cut, one is liable to cut the nerve, because it is so close. If you hook it forward and cut it, you can reach the nerve and artery; but the inferior dental artery will probably be cut, and as it is a good-sized artery its bleeding will obscure things. If, however, it does not bleed, and you proceed to take out the nerve, the distance between the lower part of the skull and the jaw is so slight that it would be difficult to remove the nerve thoroughly, on account of the difficulty in manipulation.

Dr. Davis does not believe in any of the operations on cranial nerves that require one to work through too small an opening, because too little of the nerve is removed; for instance, the operation on the inferior dental through the mouth, or the operations through the zygomatic fossa in the temporal region on the maxillary and mandibular branches of the fifth nerve.

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